GRADUATE CAPSTONE

process book.

Juliana Courogen

June 7, 2022

FEMALE RUNNING PACK INNOVATION

table of contents.

DUAL X

FEMALE-SPECIFIC ULTRA-RUNNING PACK FOR LARGE BUSTS

GRADUATE CAPSTONE

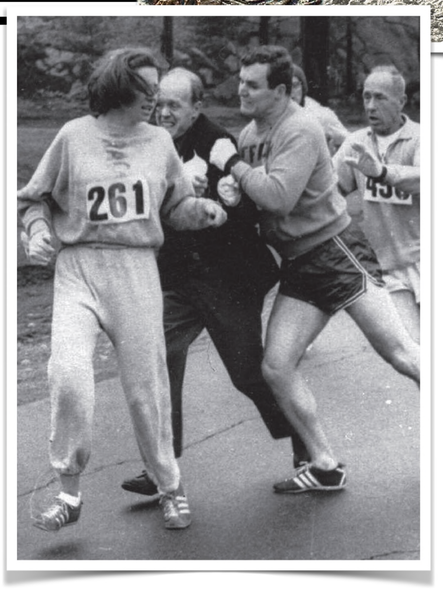
JULIANA COUROGEN

history of ultra-running.

SPORT HISTORY

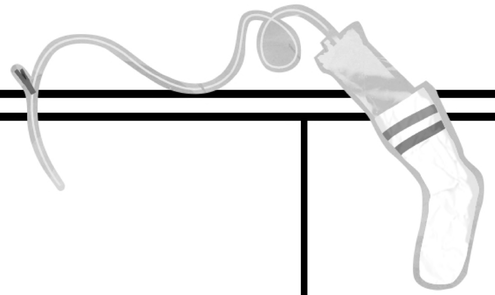
1960-70S WOMEN RACE
FEMALES ALLOWED TO RACE
MARATHONS

1972

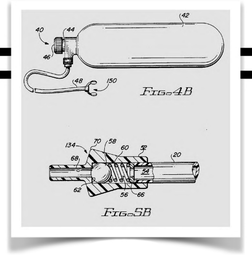


FEMALE RUNNING PACK INNOVATION

1977 SPORTS BRA
LISA LINDAHL INVENTS



1988 1ST HYDRATION PACK
PARAMEDIC MICHAEL EIDSON



1991 CAMELBAK PATENT
BITE VALVE

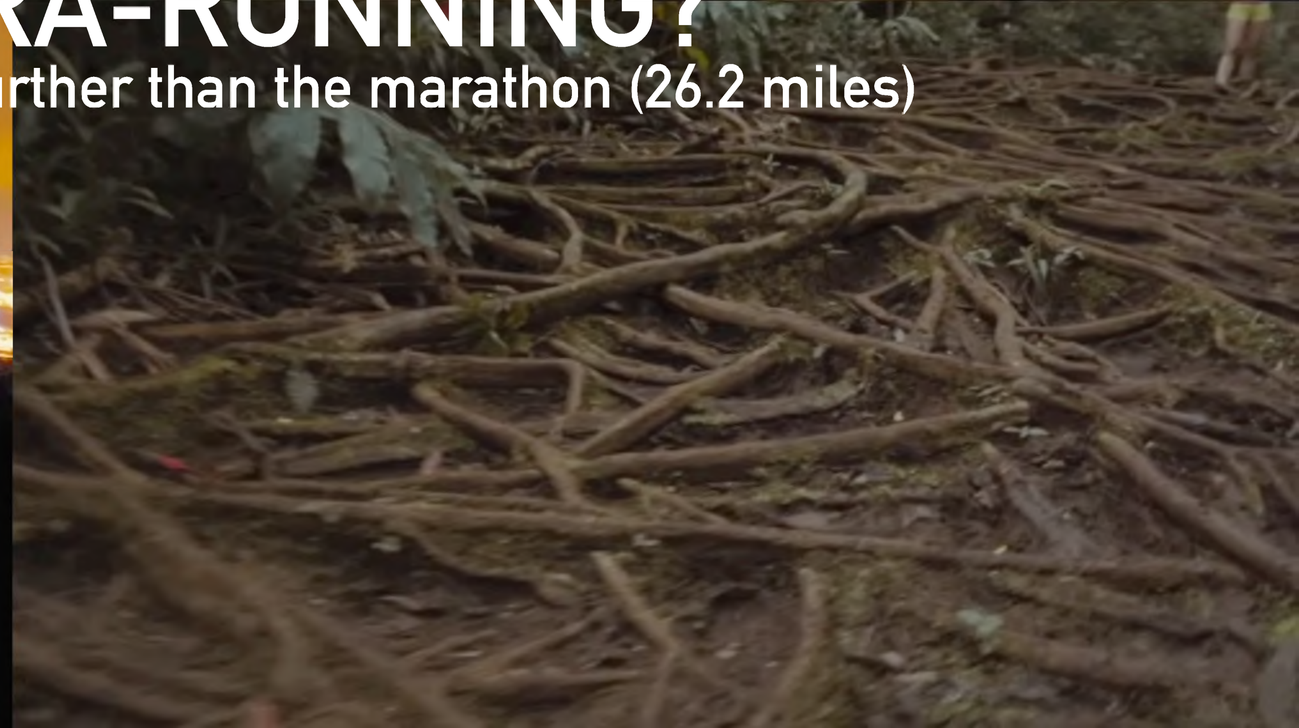
2002 BADWATER ULTRA
PAM REED WINS OVERALL - 217KM
ULTRAMARATHON

2003 CATALYST PACK
FIRST RUN-SPECIFIC BLADDER

context.

WHAT IS ULTRA-RUNNING?

running any consecutive distance further than the marathon (26.2 miles)



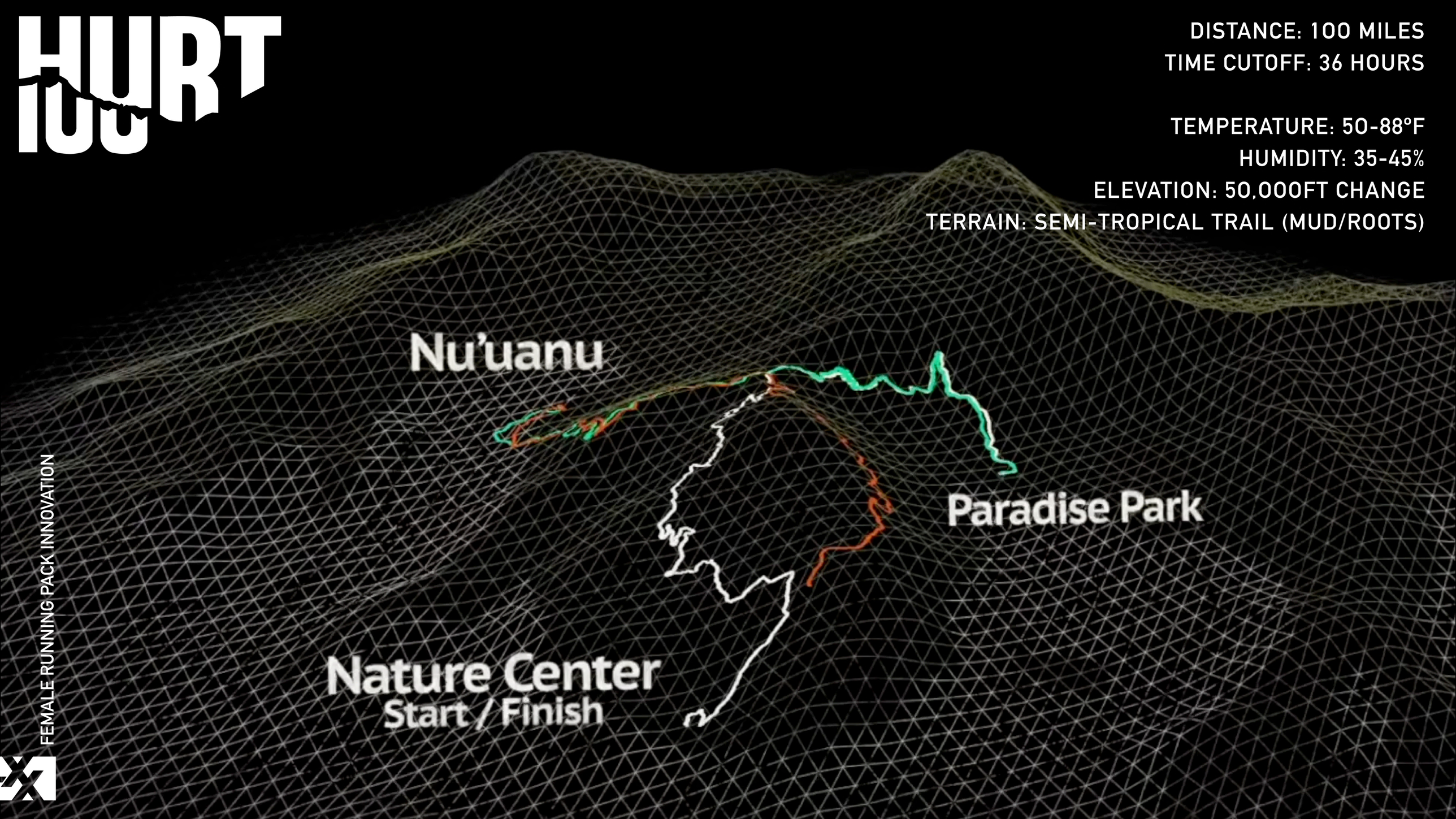
HURT 100 RACE

FEMALE RUNNING PACK INNOVATION

HURT 100

DISTANCE: 100 MILES
TIME CUTOFF: 36 HOURS

TEMPERATURE: 50-88°F
HUMIDITY: 35-45%
ELEVATION: 50,000FT CHANGE
TERRAIN: SEMI-TROPICAL TRAIL (MUD/ROOTS)



FEMALE RUNNING PACK INNOVATION

statistics.

FEMALE

23%
ULTRA-RUNNERS ARE FEMALE

141k
FEMALES RACERS

ZERO
PACKS MADE FOR C+ CUPS

ZERO

EXISTING ULTRA-RUNNING PACKS FOR FEMALES WITH C+ CUP SIZES

140,552

FEMALE ULTRA-RUNNERS IN 2018

SINCE 1996, ULTRA-RUNNING INCREASED IN POPULARITY BY

1676%

---

1 IN 4

ULTRA-FINISHERS ARE FEMALES

0.6%

FEMALES ARE FASTER THAN MALES IN RACES > 195 MILES

problem statement.

HOW COULD WE DESIGN AN ULTRA-RUNNING HYDRATION PACK FOR FEMALES WITH C+ CUPS TO PROMOTE SUPPORTIVE FIT, ACCESSIBLE STORAGE, & SWEAT MANAGEMENT WHILE RACING.

CHALLENGES

STRAP POSITIONING
UNFLATTERING, INAPPROPRIATE, UNCOMFORTABLE

CLOSURE SYSTEM
UNSUPPORTIVE, DIGS IN

OFF CENTERED FIT
PERFORMANCE INHIBITING, DISRUPTIVE

LIMITED STORAGE
UNCOMFORTABLE PLACEMENT OVER NIPPLE

define athlete.

ATHLETE

AGE: 20-60
BODY TYPE: C-DD CUPS
PHYSICAL CONDITION: ENDURANCE RUNNER
MILES RANGE: 5-100 MILES

FUEL

FLUID

FRICTION

FORM (POSTURE)

FATIGUE

athlete journey.

PRE-RACE

PREPARATION INCLUDES TRAINING, PACKING, AND WARM-UP

AID STATIONS

ATHLETES REPLENISH FLUIDS + FUEL AND CHANGE CLOTHES/SHOES.

ELEMENTS / TERRAIN

PERFORM ACTIONS RANGING FROM RUNNING TO CLIMBING.

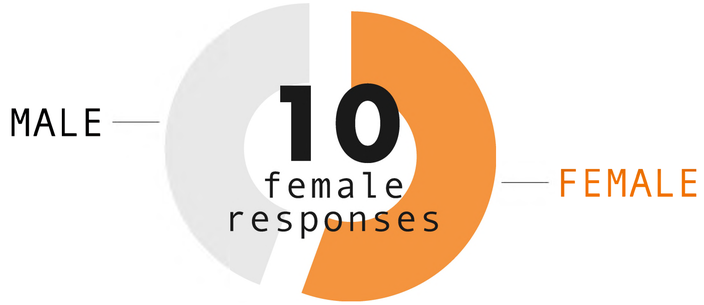
ZERO ACCESS
CAR KEYS

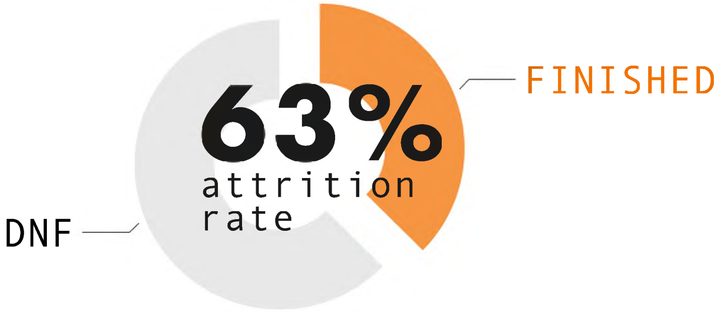
FREQUENT ACCESS
FUEL + WATER

AID STATION ACCESS

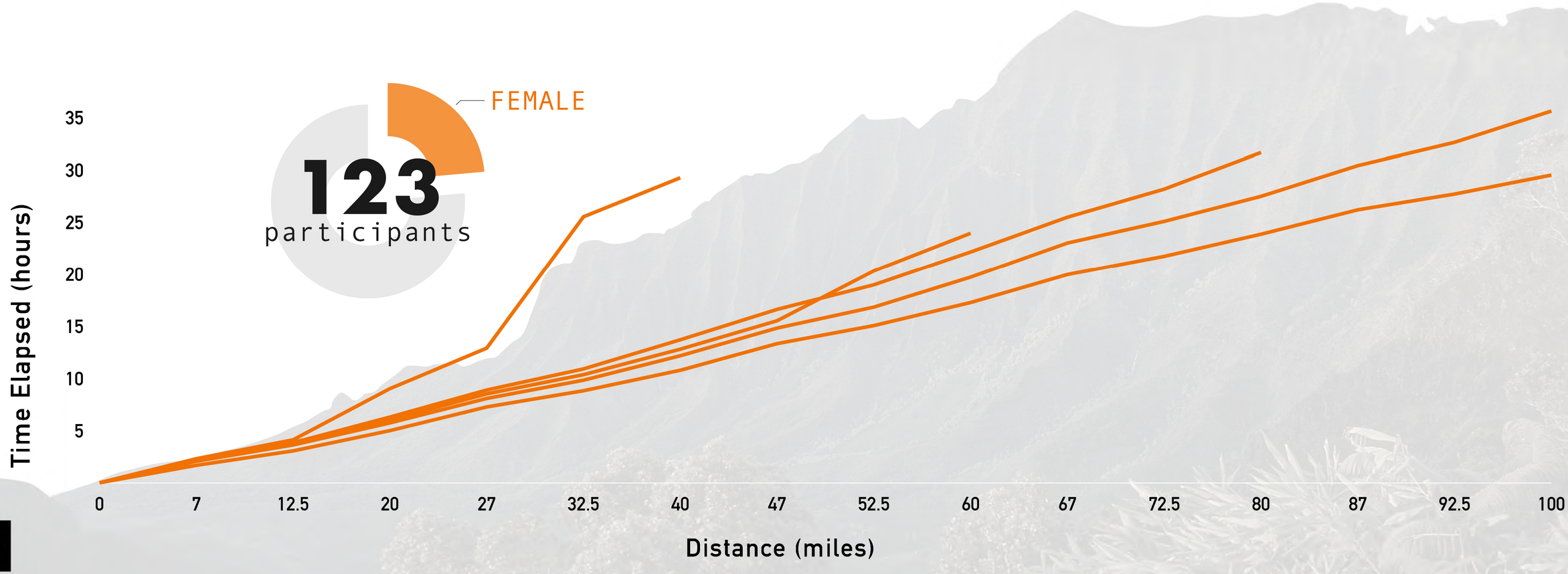
- ✓dry bag
- ✓sun hat
- ✓sun glasses
- ✓wind/waterproof layer
- ✓sweat rag
- ✓keys
- ✓electrolyte powders
- ✓salt tablets
- ✓iPhone 12
- ✓battery pack
- ✓headlight
- ✓bars + gels
- ✓hydration (bottles/bladder)
- ✓collapsible trekking poles

athlete insight.

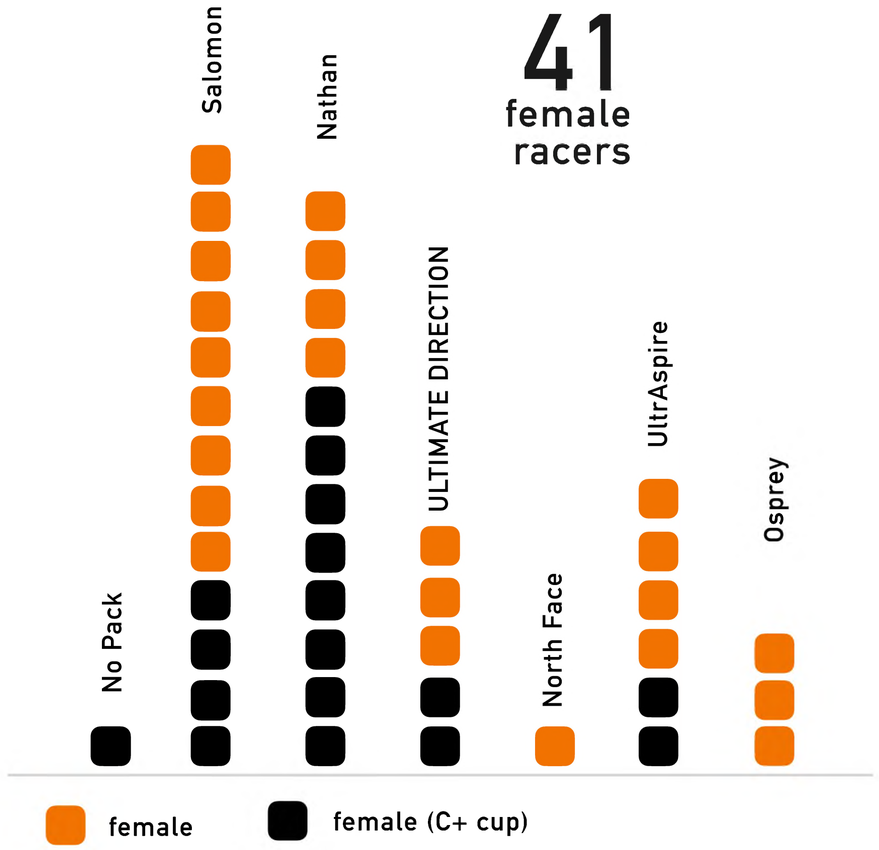

MALE
10
female
responses
FEMALE

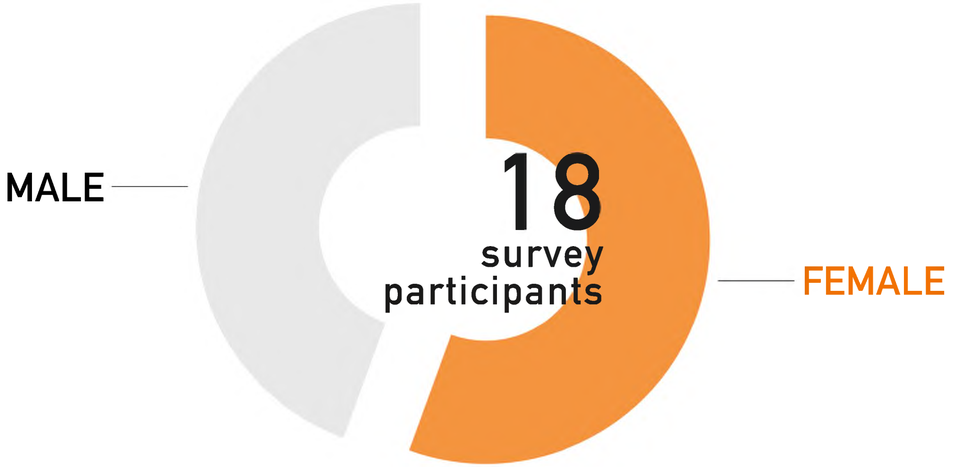

63%
attrition
rate
DNF
FINISHED

123
participants
FEMALE


Time Elapsed (hours)
35
30
25
20
15
10
5
0
7
12.5
20
27
32.5
40
47
52.5
60
67
72.5
80
87
92.5
100
Distance (miles)

FEMALE RUNNING PACK INNOVATION





1/3 of athletes surveyed report overheating wearing their current packs

do females need a specifically designed pack? **100% yes**

athlete jobs to be done.

REPLENISH CALORIES BURNED

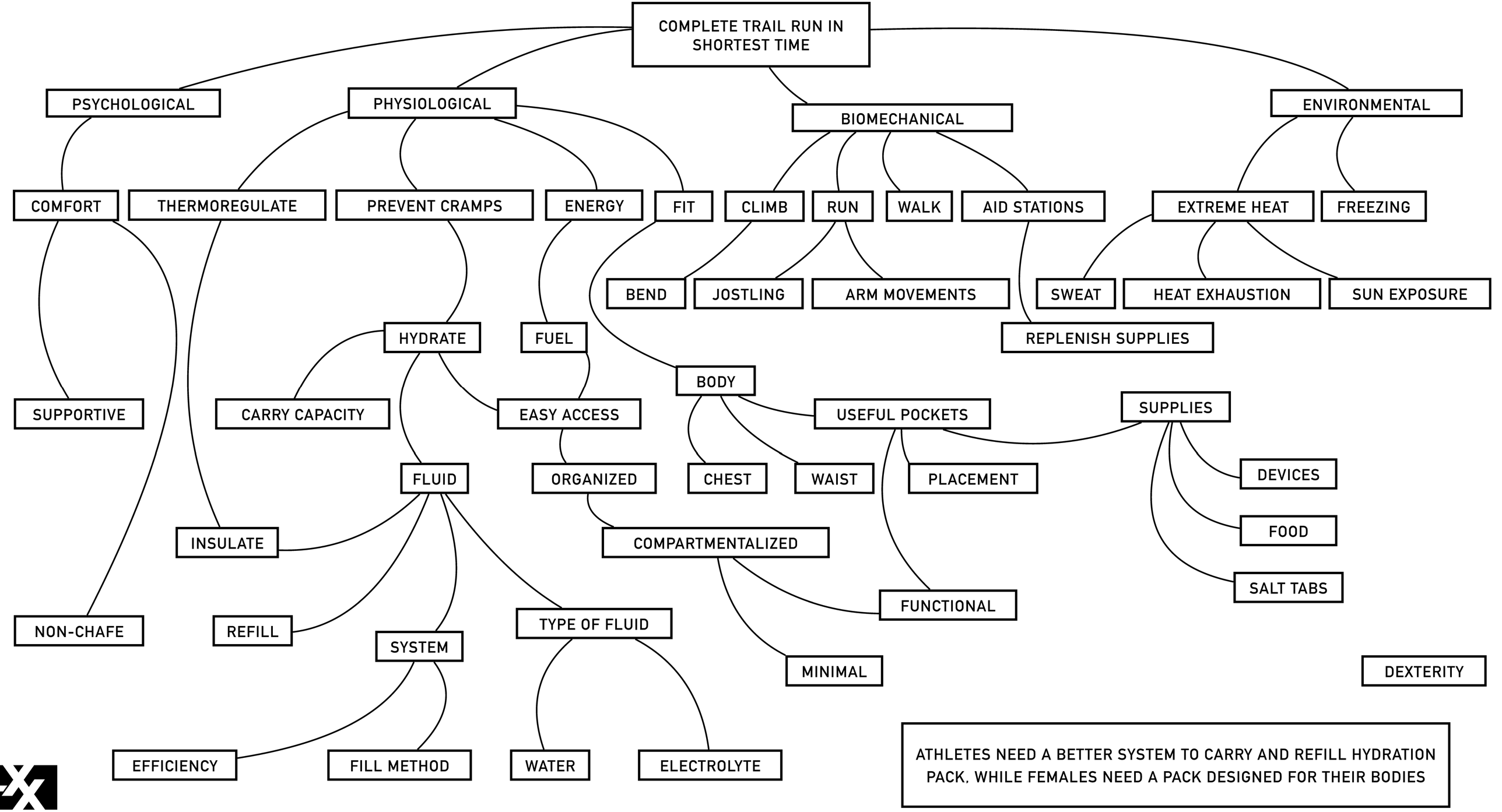
HYDRATION + BALANCING SALT LEVELS

PSYCHOLOGICAL PERSEVERENCE

AVOID INJURY + CHAFING

COMPLETE RACE WITHIN ALLOTTED TIME

CARRY NECESSARY SUPPLIES


COMPLETE TRAIL RUN IN SHORTEST TIME
PSYCHOLOGICAL
PHYSIOLOGICAL
BIOMECHANICAL
ENVIRONMENTAL
COMFORT
THERMOREGULATE
PREVENT CRAMPS
ENERGY
FIT
CLIMB
RUN
WALK
AID STATIONS
EXTREME HEAT
FREEZING
BEND
JOSTLING
ARM MOVEMENTS
SWEAT
HEAT EXHAUSTION
SUN EXPOSURE
REPLENISH SUPPLIES
HYDRATE
FUEL
BODY
SUPPORTIVE
CARRY CAPACITY
EASY ACCESS
USEFUL POCKETS
SUPPLIES
FLUID
ORGANIZED
CHEST
WAIST
PLACEMENT
DEVICES
FOOD
SALT TABS
INSULATE
COMPARTMENTALIZED
FUNCTIONAL
NON-CHAFE
REFILL
SYSTEM
TYPE OF FLUID
MINIMAL
DEXTERITY
EFFICIENCY
FILL METHOD
WATER
ELECTROLYTE
ATHLETES NEED A BETTER SYSTEM TO CARRY AND REFILL HYDRATION PACK, WHILE FEMALES NEED A PACK DESIGNED FOR THEIR BODIES

anatomy of a pack.

FEMALE RUNNING PACK INNOVATION

HANG TAB
FOR CARRYING + HANGING

BACK PANEL
FOR THERMOREGULATION + COMFORT

DRY POCKET
FOR SALT TABLETS + PILLS

BOTTLE POCKETS
FOR H2O STORAGE

WATER SLEEVE
FOR INSULATION OF BLADDER

BUNGEE SYSTEM
FOR COMPRESSION + ADJUSTABILITY

POSTERIOR EXTERNAL POCKETS
FOR LARGE STORAGE

STRAPS
FOR SUPPORT/STRUCTURE

FRONT CLOSURE SYSTEM
FOR SECURITY + ADJUSTABILITY

BLADDER POCKET
FOR SECURITY + EASE OF USE

UNDERARM POCKETS
FOR TRASH + SMALL STORAGE

MAIN COMPARTMENT
FOR LARGE STORAGE + CONTAINMENT

POLE STORAGE
FOR ACCESSIBILITY

benchmark packs.

FEMALE RUNNING PACK INNOVATION

ULTRASPIRE MOMENTUM 2.0

CORD CLOSURE FOR ADJUSTMENT / EXPANSION

S-CURVED STRAP FOR FIT OVER BUST

REAR BOTTLE POCKETS FOR ACCESS / STORAGE

$90 USD

UNISEX / MEDIUM

PACK WEIGHT: 8.4 OZ

STORAGE CAPACITY: 6L

MATERIAL: NYLON / POLYESTER

BLADDER: NOT COMPATIBLE

ULTRASPIRE ALPHA 4.0

ANGLED NECK STRAP FOR FEMALE FIT

REMOVABLE INSULATING LAYER FOR THERMOREGULATION

HONEY-COMB MESH FOR HEAT & MOISTURE MANAGEMENT

ACCESSIBLE POCKETS FOR EASE OF USE / STORAGE

$120 USD

UNISEX / MEDIUM

PACK WEIGHT: 9.8 OZ

STORAGE CAPACITY: 6L

MATERIAL: 30D NYLON / POLYESTER / MESH

BLADDER: 2L

NATHAN VAPORAIR

LOAD LIFTER TECHNOLOGY FOR WEIGHT DISTRIBUTION

ADAPTIVEFIT® SIZING SYSTEM FOR FIT / COMFORT

CINCH TECHNOLOGY FOR ADJUSTABLE COMPRESSION

22 OZ SOFT FLASK POCKETS FOR MAXIMAL CAPACITY

$142 USD

MEN'S / SMALL / MEDIUM

PACK WEIGHT: 14 OZ

STORAGE CAPACITY: 7L

MATERIAL: 60% NYLON / 40% POLYESTER

BLADDER: 2L QUICK RELEASE

SWOT analysis.

strengths

- s-curved straps / angled neck for ERGONOMICS
- full chest coverage for STORAGE
- triangular strap closure for even COMPRESSION
- rear bungee system for SECURITY
- large front & rear-facing bottle pockets
- lightweight mesh + honeycomb wicking

weaknesses

- dense materials add weight
- water-proof materials trap moisture & heat
- bungee closure gets tangled
- underarm silhouette chafes too high
- no bladder or bladder tube not secure
- annoying to wash with cords & toggles
- not designed for females with large busts

opportunity

- lightweight & breathable materials
- create moisture-wicking system back panel
- design for large busts & female anatomy
- design way to easily launder
- account for adjustable compression
- add more pockets
- use body-mapping to determine strap shape

threats

- balancing sacrifice of weight for storage
- mesh needs soft touch & hydrophobic
- moisture gets caught against skin
- water-repellant pack, breathable next to skin

Additional Pockets

How could we design the optimum number of additional pockets for trash dumping, clothing layer storage, waterproof pocket to be accessible and avoid interfering with arm swing or user movements while being easily accessible.

Strap Pockets

How could we design at least 6 strap pockets to (1) hold soft flasks comfortably without pressuring the chest while staying secure and easy to refill and insert, and (2) store goo, gels, and bars securely with easy one-handed access while allowing access and flexible order of packing that doesn't interfere with arm swing.

Bladder System

How could we design for bladder compatibility that maximizes the benefits of carrying a bladder in the main compartment for either unique or universal bladders keeping in mind weight distribution and thermoregulation of user and water.

Main Compartment

How could we design a flexible but structured main compartment that opens to show a majority of needed gear without user struggling to close compartment while remaining water-resistant and not interfering with bungee technology.

Strap Structure

How could we facilitate heat dissipation and circumvent abrasion by adapting a soft, breathable, and absorbent fabric to be lightweight but minimize exposure to harmful UV rays while applying structural shaping to the shoulder straps.

Sternum Closure Structure

How could we (1) maximize structured fit and security by shaping shoulder straps and lower sternum straps to fluidly transition into underarm panels and (2) allow single-handed operation of closure system using buckles with adjustable heights for comfortable and distributed compression.

Strap Attachment + Elastic System

How could we use multiple bungee elastic anchors to apply primary tension from rear of pack to promote proper running posture and further adjustability to more users without interfering with comfort of back paneling and pocket space.

Back Panel

How could we incorporate tapered chimney-wicking heat dissipation method in the design of a maximal coverage back panel that's efficient in thermoregulation without warming the bladder water while also considering the pressure and coverage on the neck.

performance goals.

FIT + COMFORT

75%

OF ATHLETES REPORT GREATER SUPPORT IN THE BUST

PACK WEIGHT

<10

OUNCES

PACK WEIGHT VERSUS STORAGE CAPACITY

GEAR ACCESSIBILITY

75%

OF ATHLETES REPORT GREATER EASE OF ACCESS TO GEAR

COOLING + EVAPORATION

10%

FASTER EVAPORATION RATE COMPARED TO WEIGHT

technologies.

QUAD PLANE

COMPRESSION IN 4 DIRECTIONS STEMMING FROM THE POSTERIOR TO ANTERIOR AND VICE VERSA.

EQUILIBRIUM

CALCULATED TRADE-OFF BETWEEN GEAR CARRYING CAPACITY AND WEIGHT.

DRY-TEX

HEXAGONAL PATTERN FUSION BETWEEN HYDROPHILIC AND HYDROPHOBIC TEXTILES TO BRING THERMOREGULATION TO THE PRODUCT.

define focus.

FEMALE RUNNING PACK INNOVATION


SUPPORTIVE FIT
ACCESSIBLE STORAGE
MOISTURE MANAGEMENT

value proposition.

STRAP-DOWN

FORCE DISPERSAL

AVOIDANCE

HINDRANCES

LIGAMENT DETERIORATION

POOR POSTURE

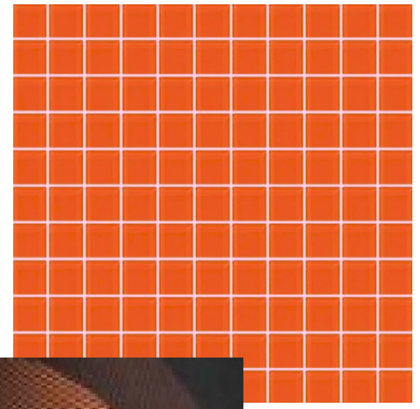
OPPORTUNITY

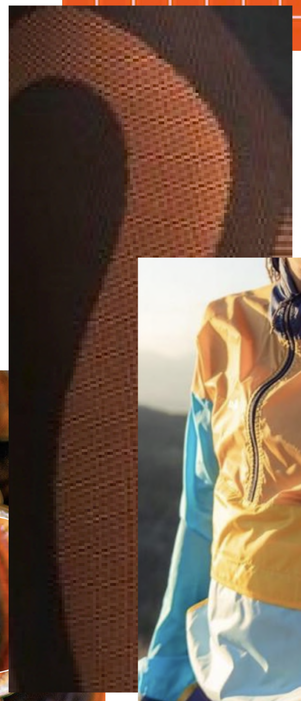
LONGER RUNNING CAREER

FASTER PERFORMANCE

BETTER FORM

moodboards.



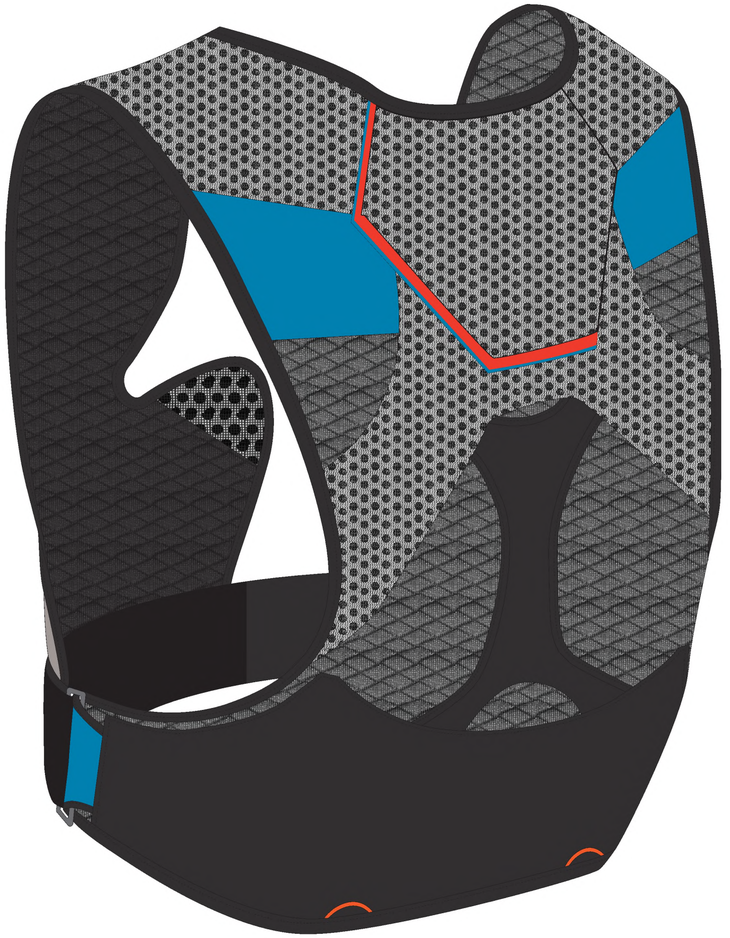


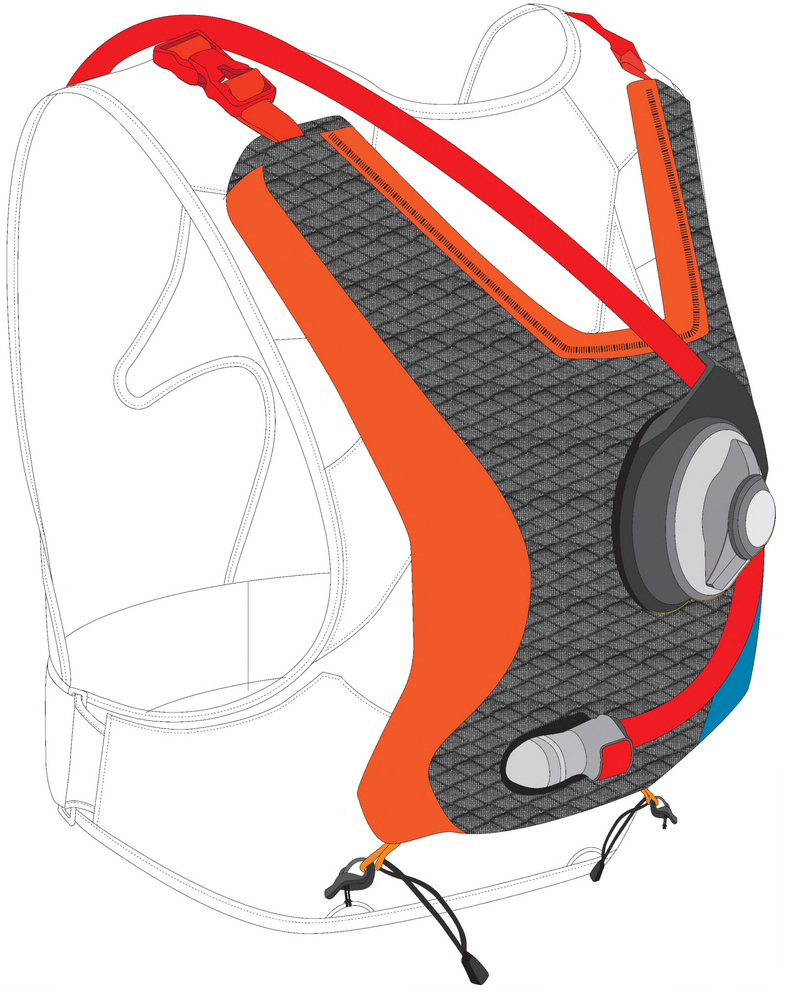
surface

BLACK 6C

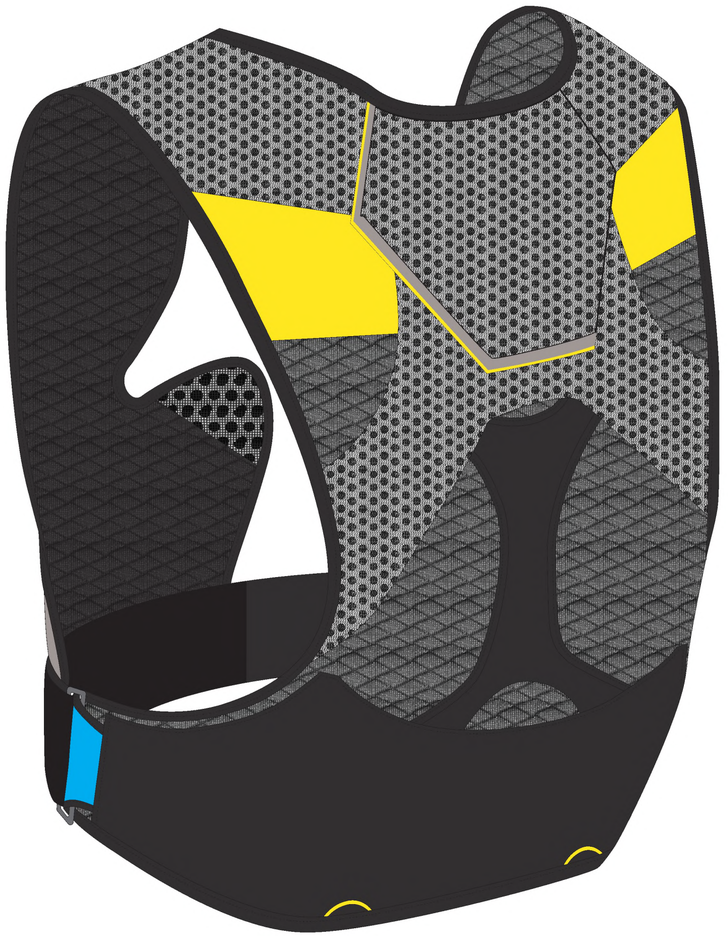
P45-8C	P116-16C	P24-8C	
P45-8C	803 U	P115-8C	

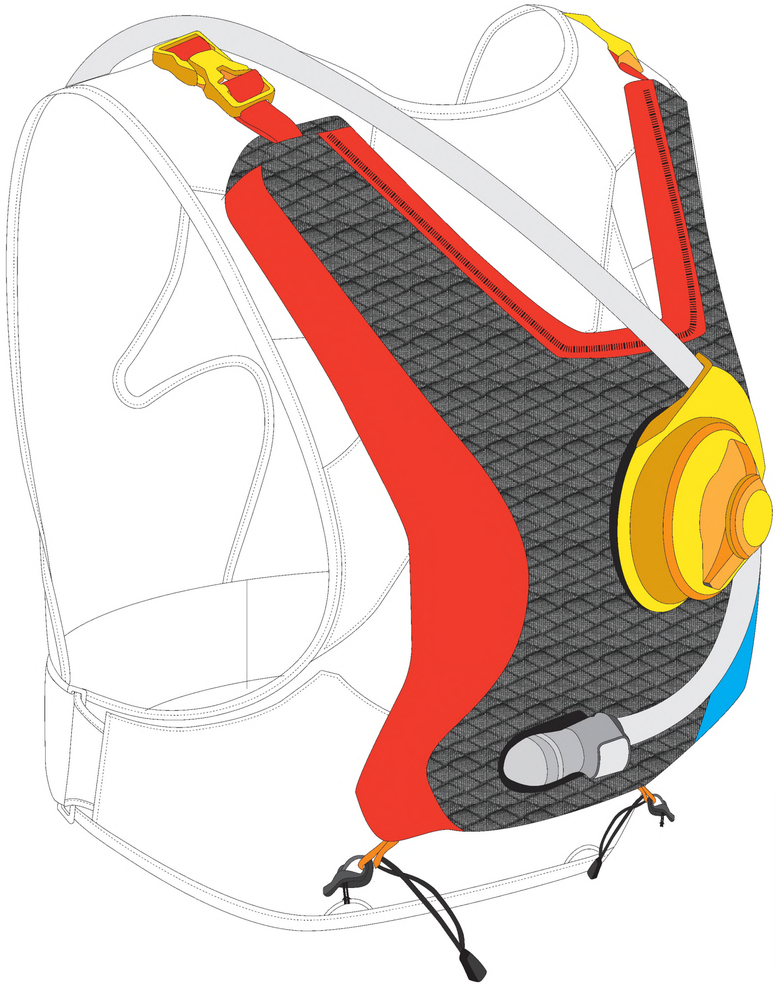
colorways.





P45-8C P116-16C P24-8C BLACK 6C





P45-8C 803 U P115-8C BLACK 6C

materials research.

MATERIALS RESEARCH

FEMALE RUNNING PACK_INNOVATION

Materials + Manufacturing

Bladder
Hydration bladders are made of Polyurethane
Benefits: flexible, net-like, breathable

Body Fabric
Nylon Spandex is a dry knit, elastomeric fiber made from Polyurethane.
Benefits: Elasticity, comfortable, lightweight, sweat-resistant, abrasion-resistant, pile + static-free.

Polyester (Polyethylene Terephthalate) synthetic woven or knit.
Benefits: Durable, lightweight, quick-dry, retains shape

Cool-tech fabrics for back panel

Buckles + Safety Whistle
Buckles are injection molded Polyoxymethylene.
Benefits: strong, durable
*whistles can be embedded by forming the plastic with a specific shape

Chest Straps
Straps are made from woven, synthetic Nylon, Polyester, or Dyneema webbing
Benefits: strong, low stretch

Foam
PolyEthylene is closed-cell
Benefits: lightweight, flexible, resilient to mildew + bacteria

Insulation Sleeves
Neoprene is a synthetic form of rubber, Using free radical emulsion polymerization, it's manufactured with 90% Polyester and 10% spandex
Benefits: Durable, insulating

Mesh
Mesh backing is made of Nylon or Polyester and is woven.
Benefits: flexible, net-like, breathable

Mylar
Mylar is an extruded film of Polyethylene Terephthalate.
Benefits: Insulating, reflective

Paracord
Elastic strands, typically natural rubber, inside braided, knit, or woven nylon, PP, or cotton sheath.
Benefits: elasticity, 100% elongation

Pull Tabs
Made of cotton, polyester, or a blend
Benefits: Strong, Durable

Tubing
Tubes are made of silicone or latex. It can be molded, extruded or dip manufactured.
Benefits: Sterile, seamless, clear

Water-proof Zippers
Fabric-reinforced ThermoPlastic Polyurethane (TPU) layer thermobonded with zipper referenced above.
Benefits: breathable, flexible, low/high temperature resistant (-40F, 212F)

Zippers
Plastic molded acetal polymer extruded though a mold to shape teeth, fabric-reinforced for application.
Benefits: plastic > metal to avoid freezing

Assembly

Sewn
Most assembly is performed during the sewing process. Finishes and taped seams are added in some junctions to for water-proof components.

Attached
Other components are attached with cords or tying methods.

Configuration
A small amount of components are manufactured to slide or be snapped into place.

materials.

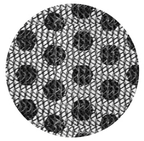
POWER MESH
84% nylon / 16% spandex, woven
4-way stretch + compression

WEBBING
nylon, flat woven
strength + durability

ELASTANE
polyurethane knit
compression

BEMIS ADHESIVE
polyurethane, non-woven
structure

RIPSTOP NYLON
Nylon, woven
structure



Textile layers #1
Woven or knit nylon layering
Breathability

Textile #2
Woven or knit polyester
Moisture wicking

ELASTIC CORD
rubber + polyester, braided
elasticity + strength

TRIM
polyester + nylon, knit
stretch

PLASTIC COMPONENTS
polyoxymethylene
strength + ease of use

VELCRO
polyamide, non-woven
closure

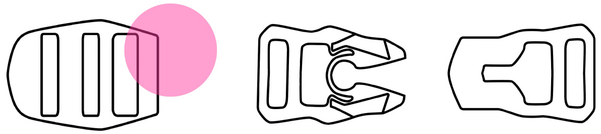
FOAM
Closed-cell, polyisocyanates + polyol
cushioning + breathability

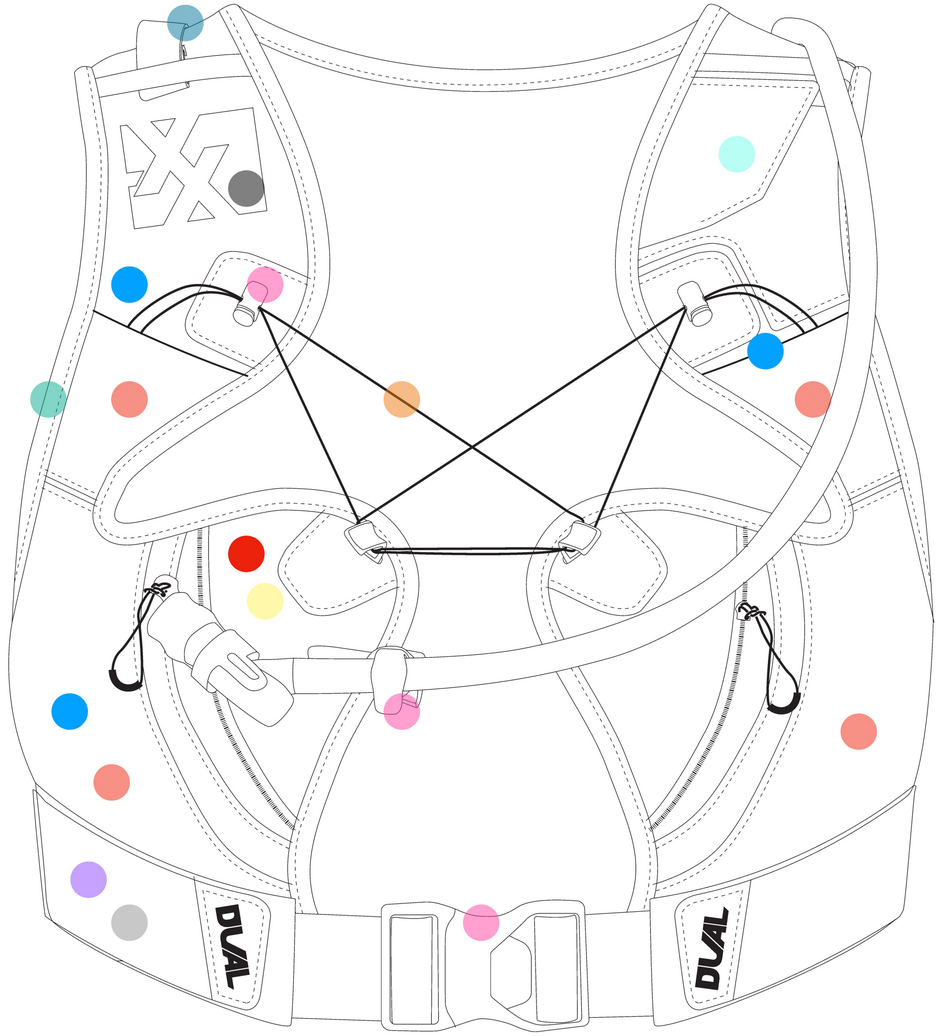
MESH
Nylon mesh woven, heat
Structure

ZIPPER
polyoxymethylene
strength + ease of use

CONSTRUCTION METHODS

LASER PERFORATIONS	
SEWING	8 SPI SNTS + DNTS 8 SPI ZigZag stitch





FRONT VIEW

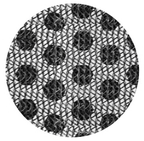
POWER MESH
84% nylon / 16% spandex, woven
4-way stretch + compression

WEBBING
nylon, flat woven
strength + durability

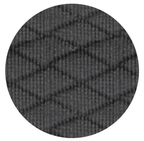
ELASTANE
polyurethane knit
compression

BEMIS ADHESIVE
polyurethane, non-woven
structure

RIPSTOP NYLON
Nylon, woven
structure



Textile layers #1
Woven or knit nylon layering
Breathability



Textile #2
Woven or knit polyester
Moisture wicking

ELASTIC CORD
rubber + polyester, braided
elasticity + strength

TRIM
polyester + nylon, knit
stretch

PLASTIC COMPONENTS
polyoxymethylene
strength + ease of use

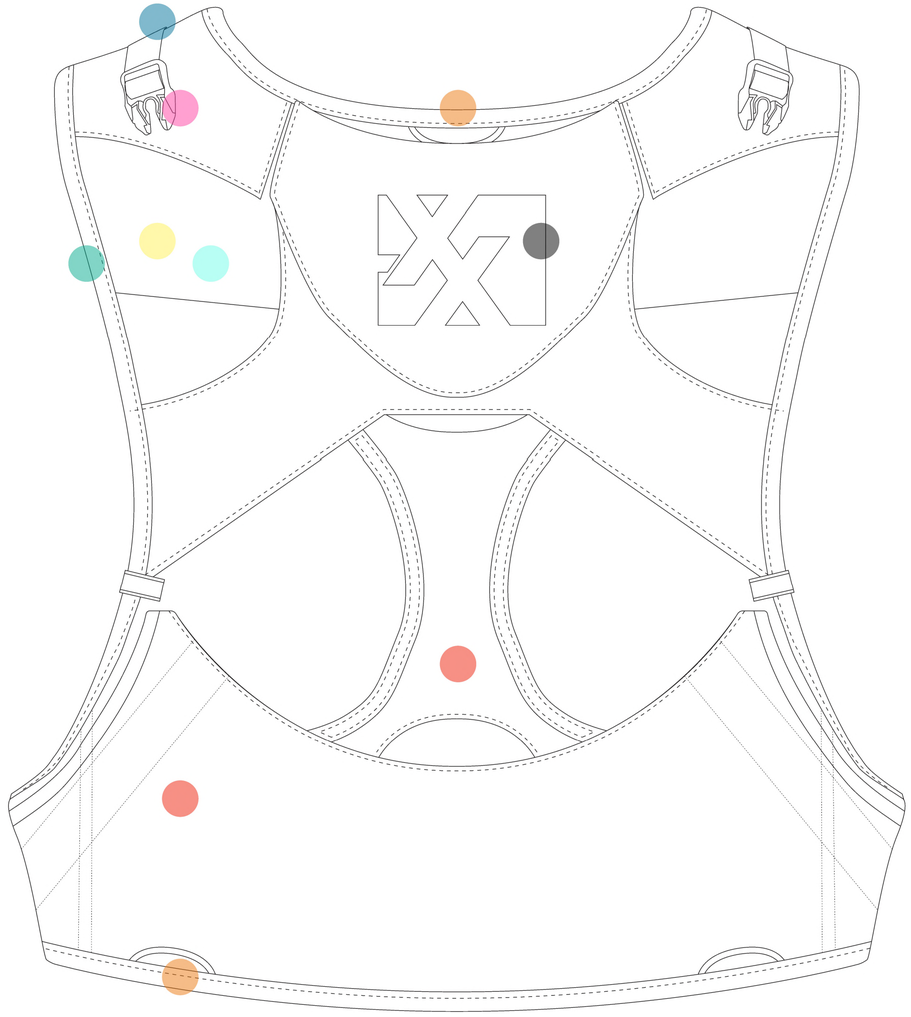
VELCRO
polyamide, non-woven
closure

FOAM
Closed-cell, polyisocyanates + polyol
cushioning + breathability

MESH
Nylon mesh woven, heat
Structure

ZIPPER
polyoxymethylene
strength + ease of use

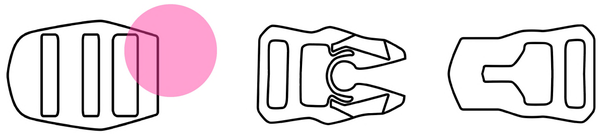
BARE BACK VIEW



CONSTRUCTION METHODS

LASER PERFORATIONS

SEWING	8 SPI SNTS + DNTS 8 SPI ZigZag stitch



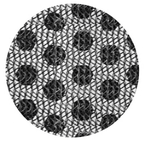
POWER MESH
84% nylon / 16% spandex, woven
4-way stretch + compression

WEBBING
nylon, flat woven
strength + durability

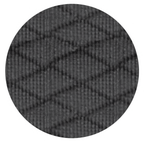
ELASTANE
polyurethane knit
compression

BEMIS ADHESIVE
polyurethane, non-woven
structure

RIPSTOP NYLON
Nylon, woven
structure



Textile layers #1
Woven or knit nylon layering
Breathability



Textile #2
Woven or knit polyester
Moisture wicking

ELASTIC CORD
rubber + polyester, braided
elasticity + strength

TRIM
polyester + nylon, knit
stretch

PLASTIC COMPONENTS
polyoxymethylene
strength + ease of use

VELCRO
polyamide, non-woven
closure

FOAM
Closed-cell, polyisocyanates + polyol
cushioning + breathability

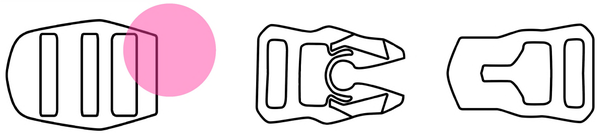
MESH
Nylon mesh woven, heat
Structure

ZIPPER
polyoxymethylene
strength + ease of use

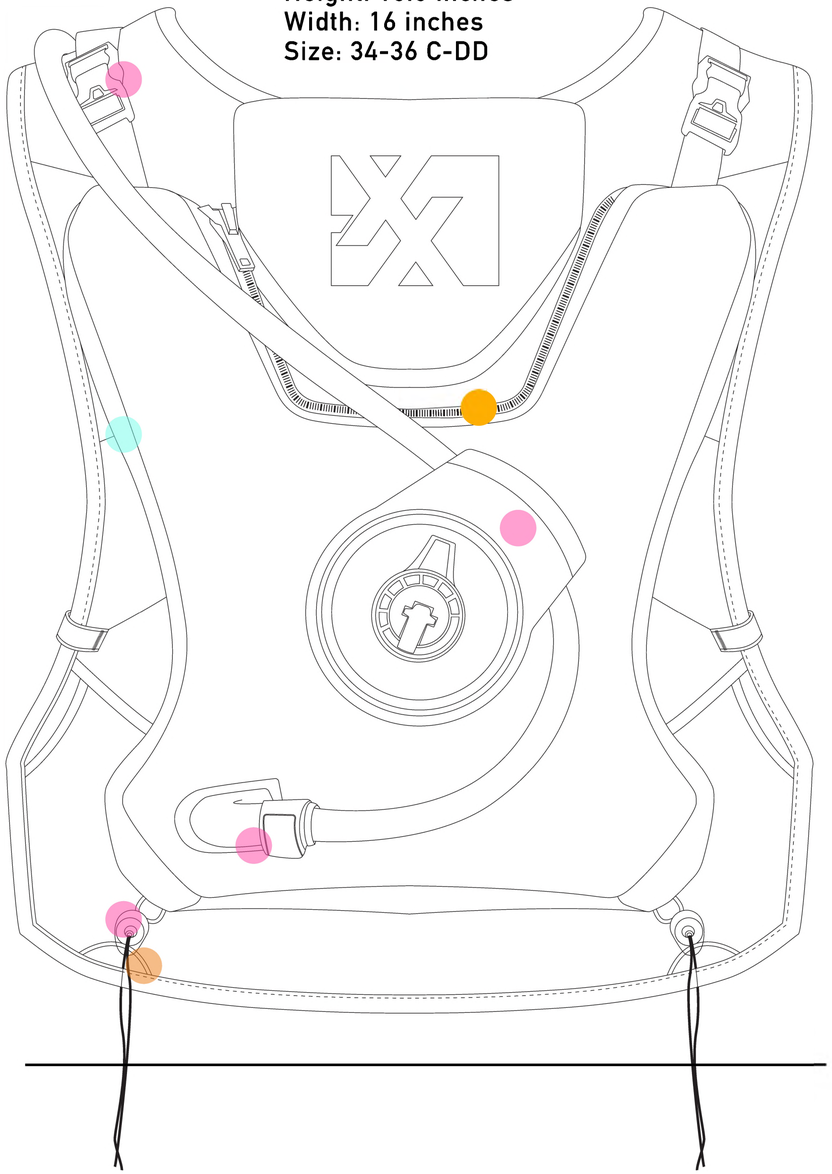
CONSTRUCTION METHODS

LASER PERFORATIONS

SEWING	8 SPI SNTS + DNTS 8 SPI ZigZag stitch



Height: 15.5 inches
Width: 16 inches
Size: 34-36 C-DD



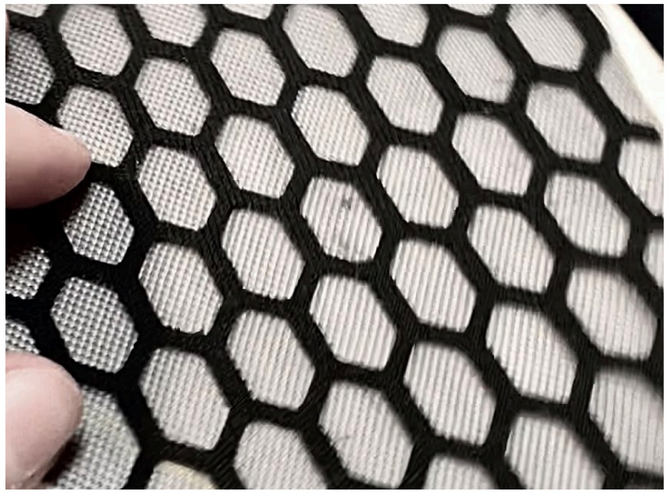
BLADDER BACK VIEW

material innovation.

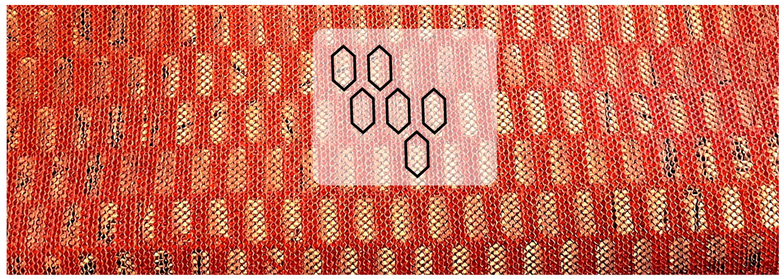
MATERIAL INNOVATION

MATERIALS INSPIRATION

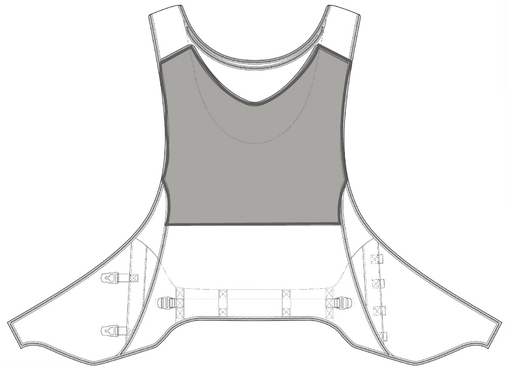
MATERIALS INNOVATION



BUILD



TEXTILE APPLICATION



HEAVY HEAT + SWEAT ZONE

MATERIAL GOALS

TOUCH-POINTS

LIMIT THE AREA COMING IN CONTACT WITH THE SKIN.

CHANNELING

HONEY-COMB NETWORK TO SPREAD MOISTURE TO COVER A LARGER SURFACE AREA FOR FASTER EVAPORATION TO COOL THE ATHLETE.

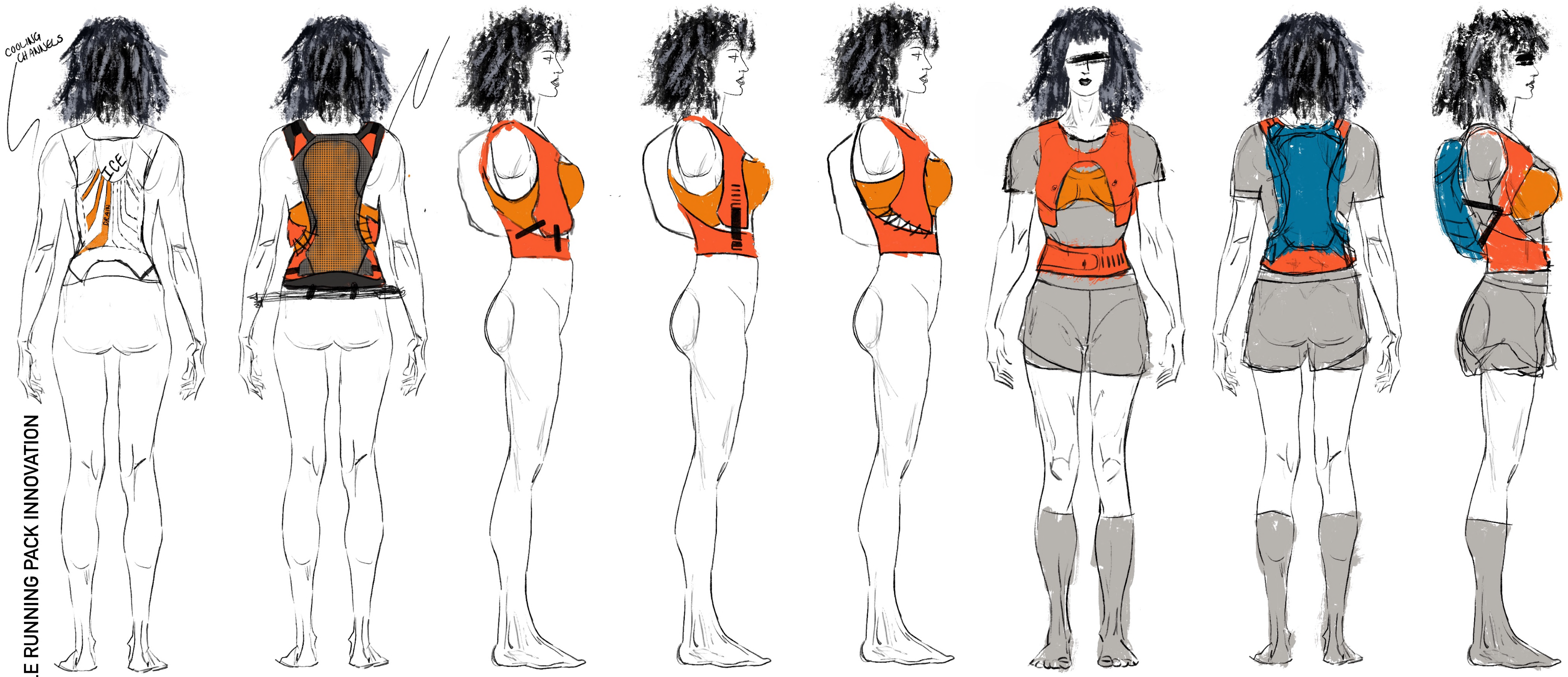
DUAL-LAYER WICKING

MINIMIZED TOUCH POINTS TO THE SKIN AND IMPROVED EVAPORATION RATE.

initial sketches.

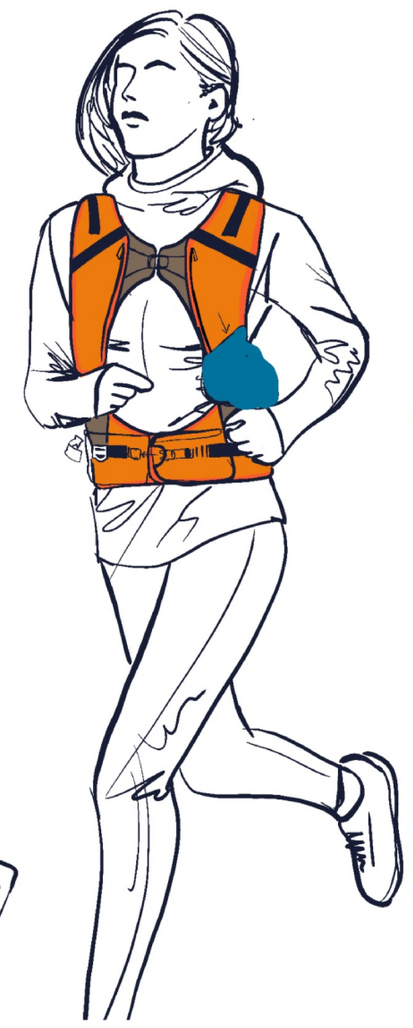
FEMALE RUNNING PACK INNOVATION

SKETCHES

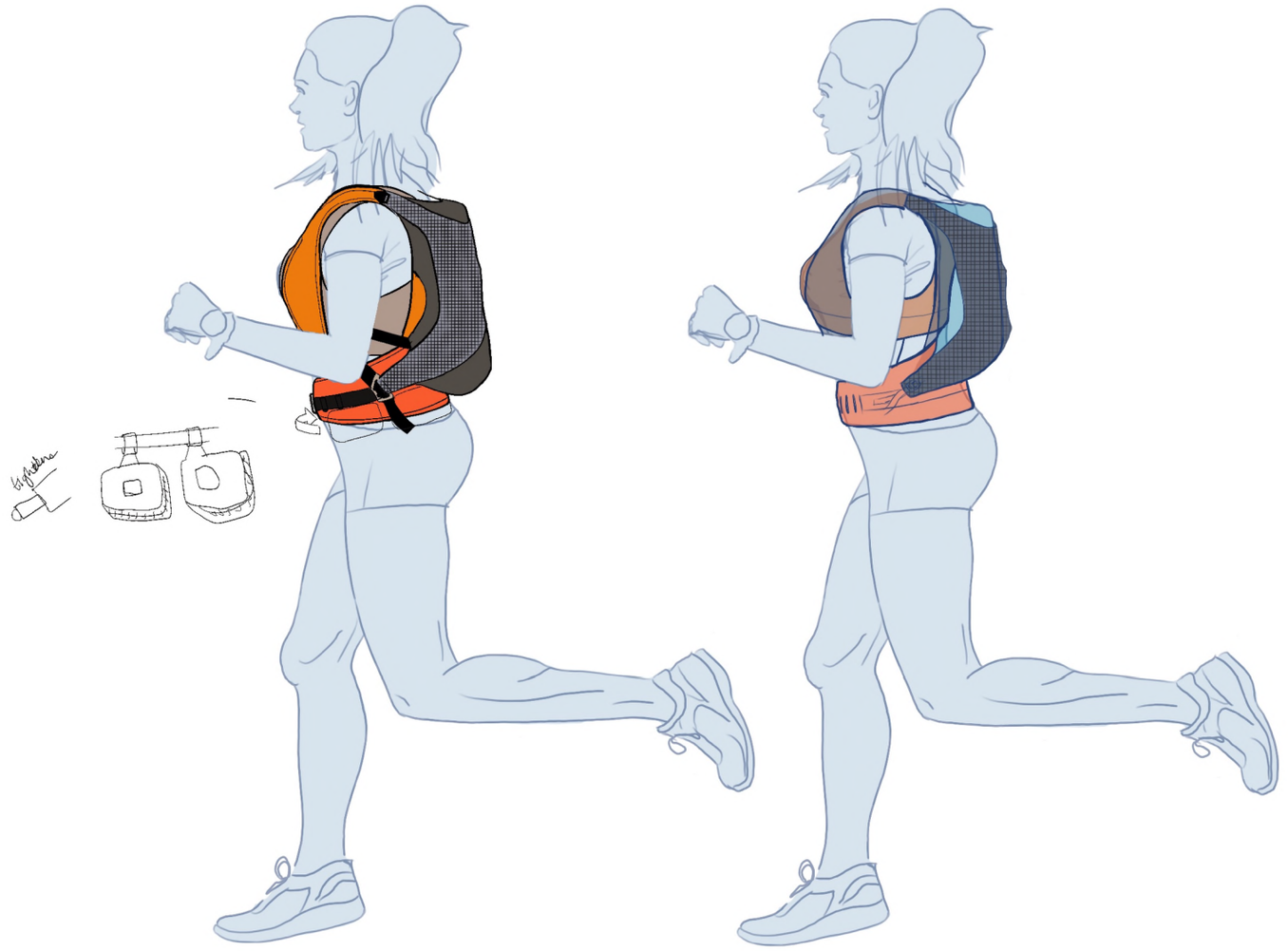


FEMALE RUNNING PACK INNOVATION

SKETCHES



FEMALE RUNNING PACK INNOVATION

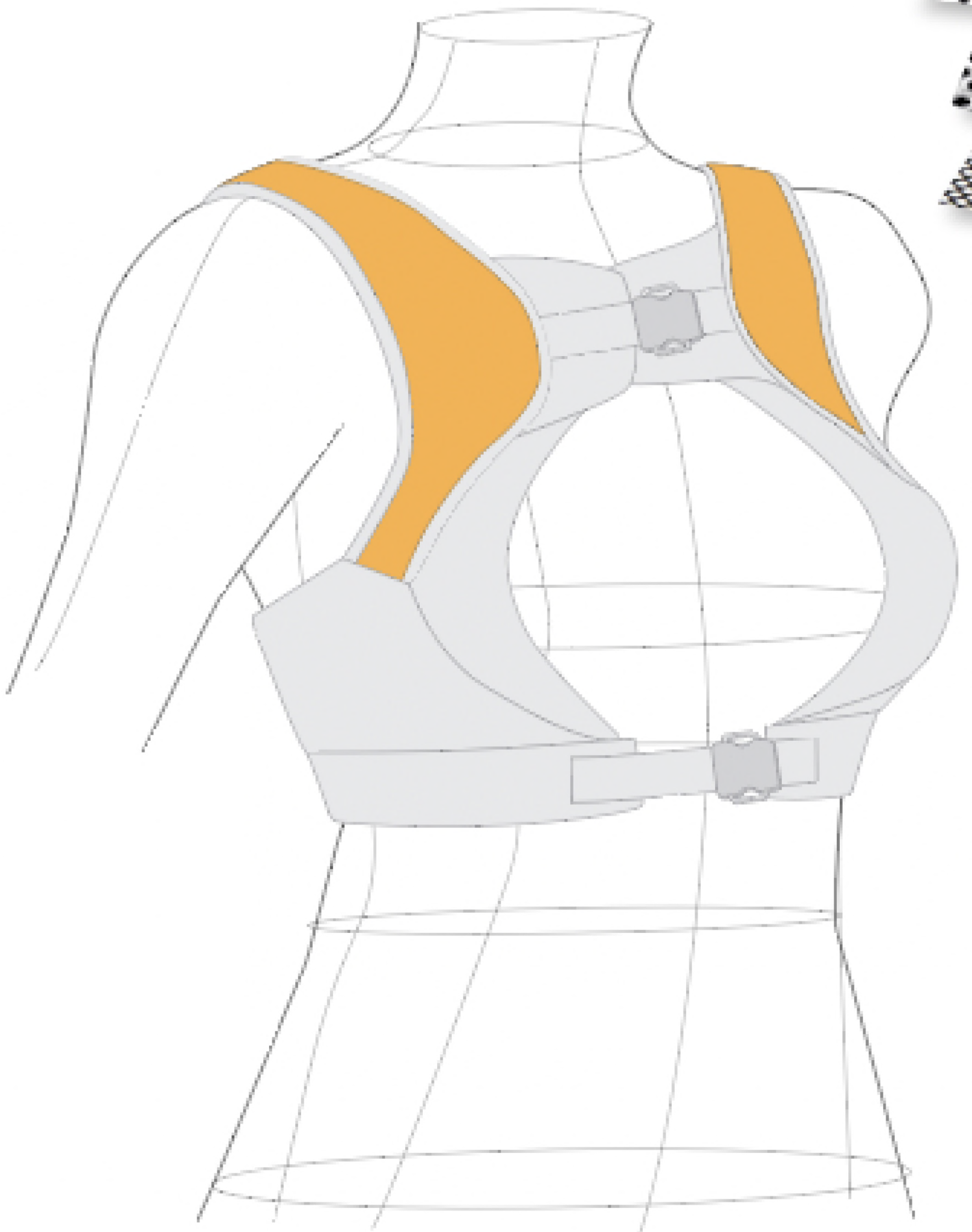


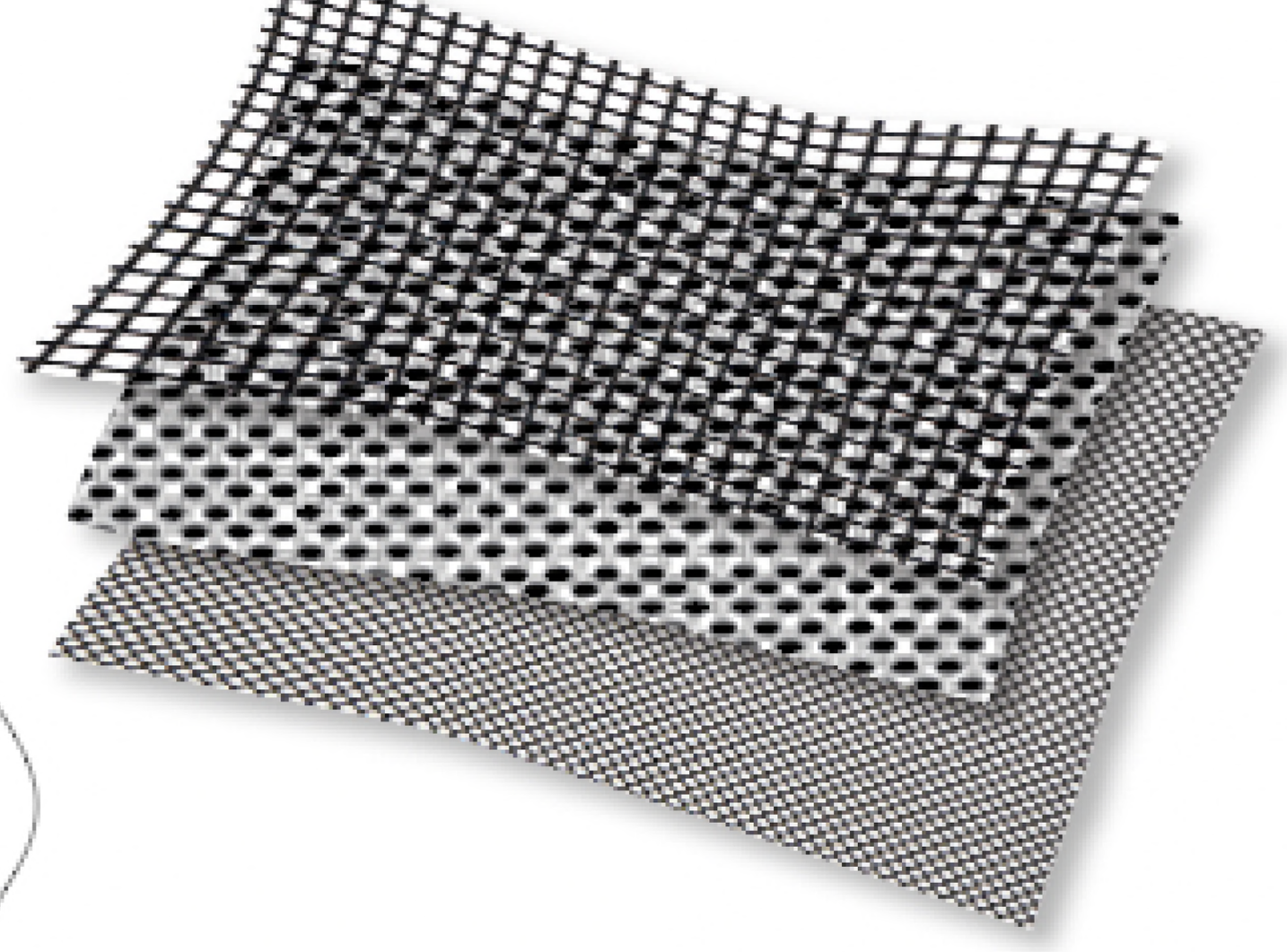
SKETCHES


"Fatigue is the thief of dexterity & coordination."
DO THE EASY THING FIRST
WEAR DOES BIB NUMBER GO?
COMPRESSION/ STRETCH
EXPANSION
FIT/ ADJUSTABLE
ADJUST IN BACK
ADJUSTS FROM BACK
TECHNOLOGY
dual bladder
removeable
ITEMS TO CARRY
2 L water
3 Electrolyte Powders
4 BARS
MEDKIT
LIGHT LAYER
PHONE
AIRPOD PHONES
KEYS
GLASSES
TRASH
SALT TABS
-TIPEN
HIGHLIGHT RAG
FEEL PRODUCT
BENEFIT
SOUL
SIDE VIEW
THERMOREGULATION
MESH
SMALL NEOPRENE STRIP
HIDDEN CINCH
LOWEST PROFILE CLOSURE FOR UNDER LAYER
NO BUCKLES ALONG SPINE
CLOSURE
BUCKLE
COMPRESS
• Simplify
• Intuitive
• Ease of use
• Layers support but layers = heat
• Fatigue is the thief of dexterity + coordination
FEMALE RUNNING PACK INNOVATION

Initial ideation.

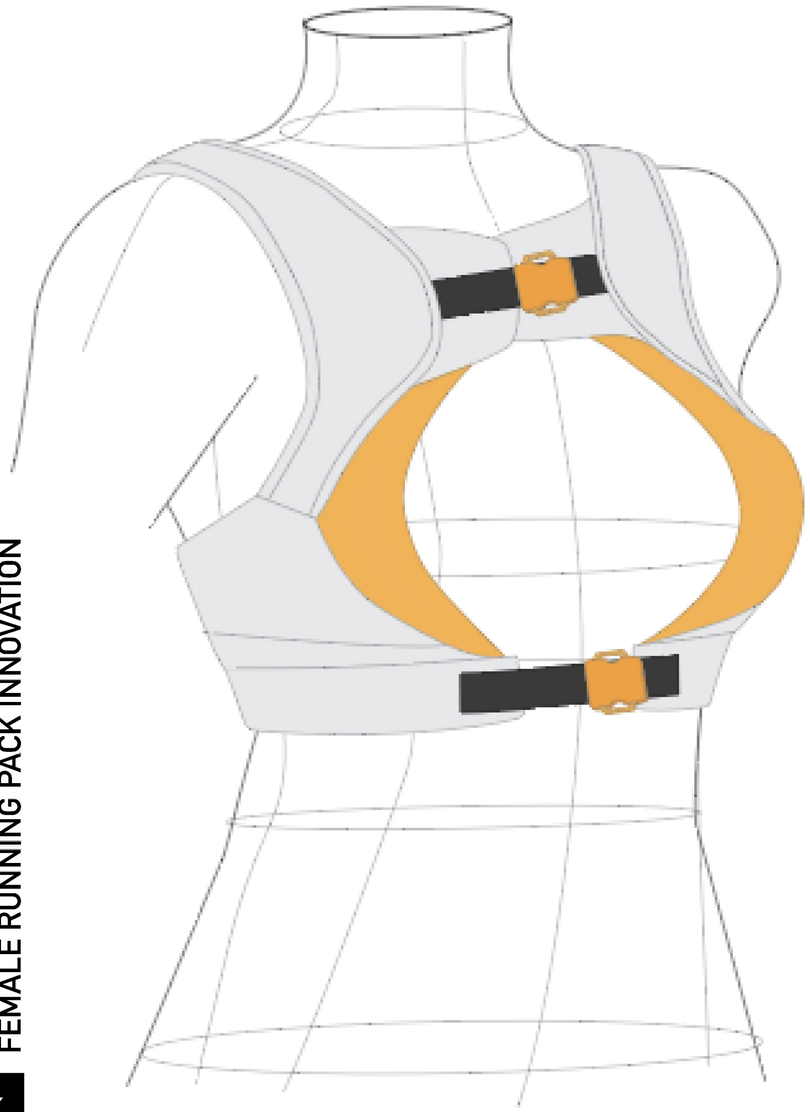
TETRA-DRY

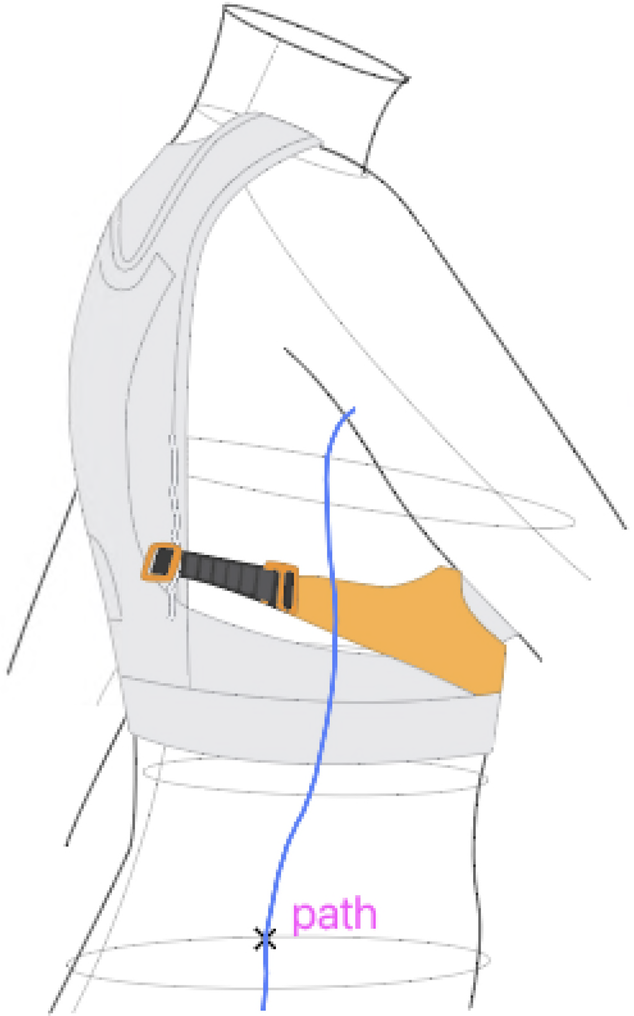


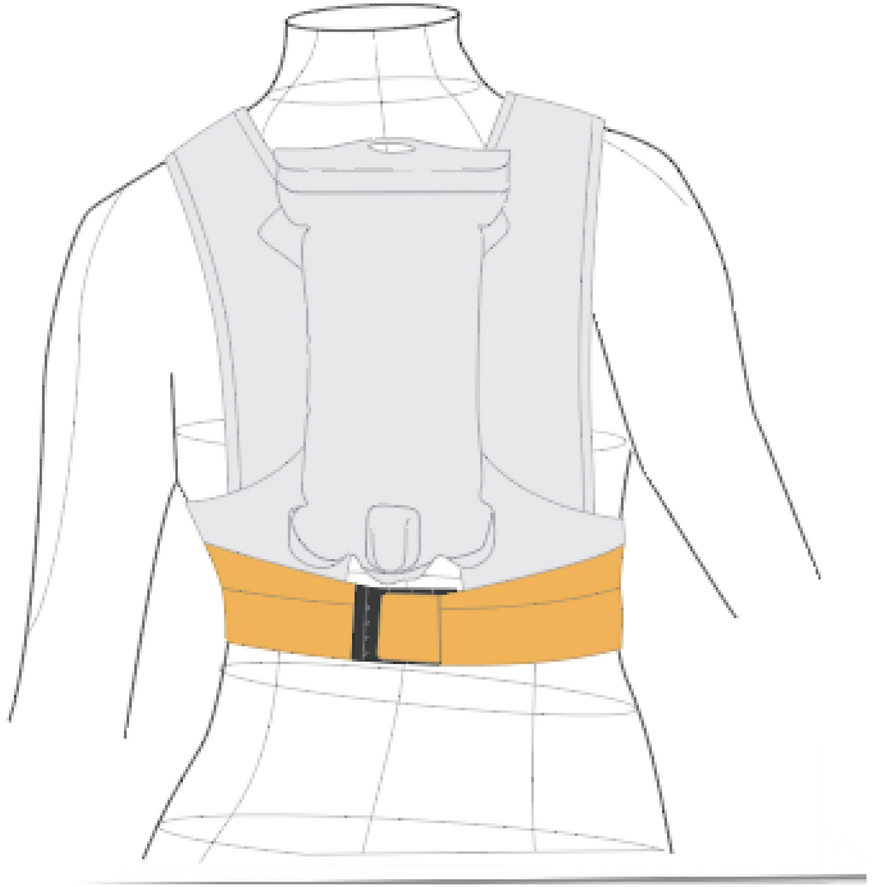


FEMALE RUNNING PACK INNOVATION

BUST FIT

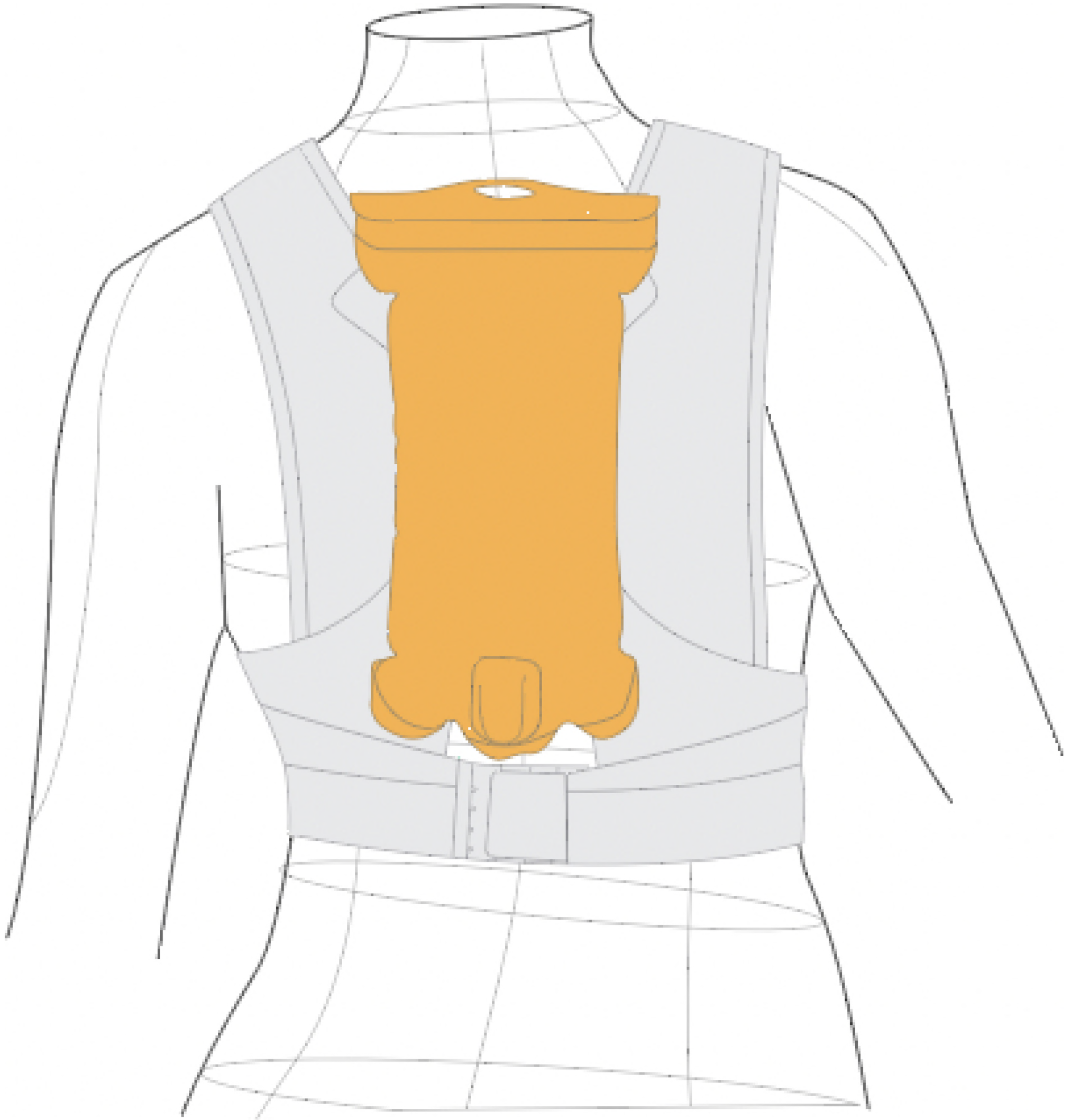


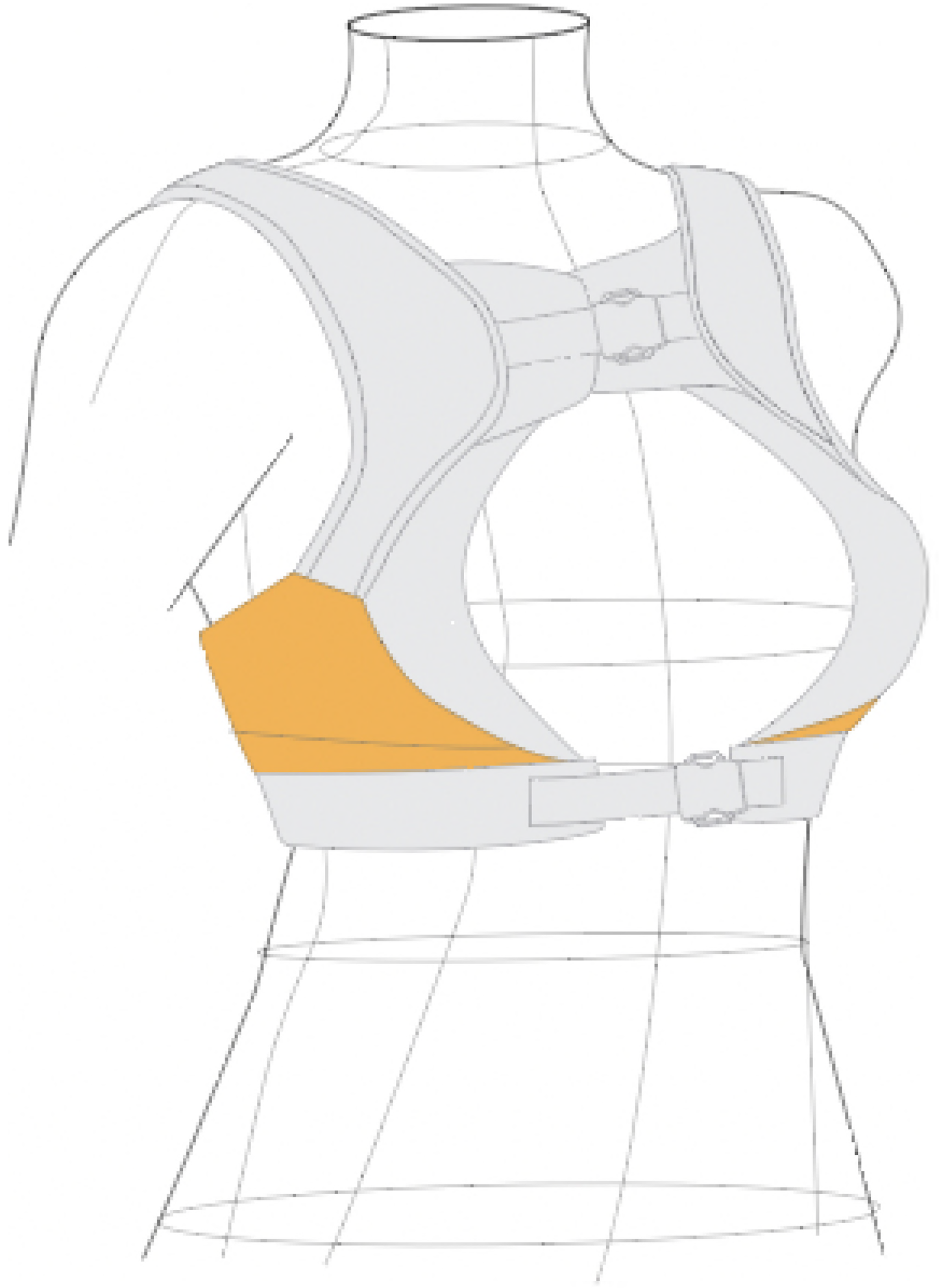




FEMALE RUNNING PACK INNOVATION

ACCESSIBLE STORAGE





FEMALE RUNNING PACK INNOVATION

TECHNICAL FLAT

FEATURES + BENEFITS

BACK PANEL
FOR CUSHIONING

ICE POCKET
FOR NEXT-TO-SKIN COOLING

BEMIS FLAT
FOR STRAP STRUCTURE

MESH PANEL
FOR BUST SHAPE

SIDE POCKET
FOR SMALL FUEL STORAGE

CORD CLOSURE
FOR COMPRESSION + ADJUSTABILITY

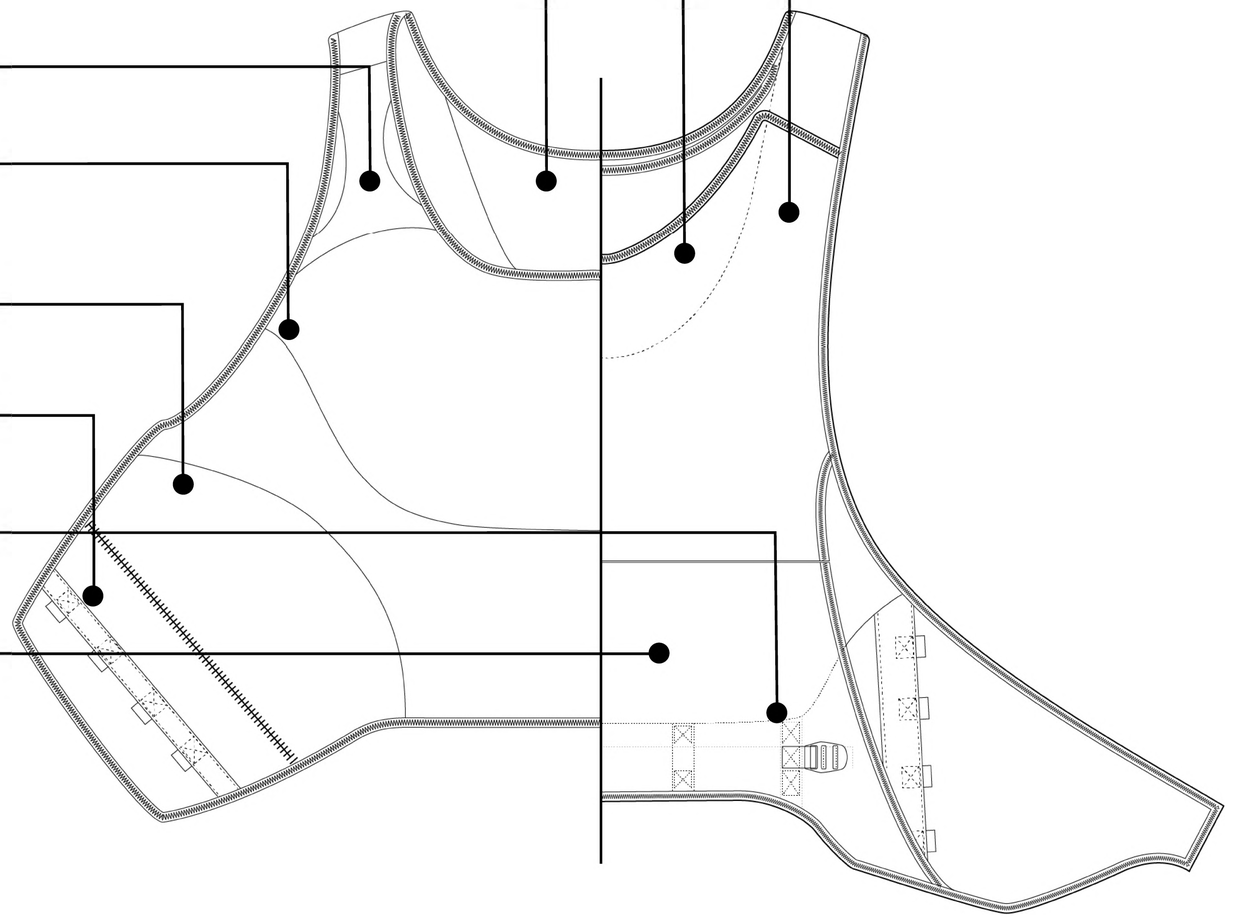
FASTENING SYSTEM
FOR ADJUSTABILITY + FLEXIBLE SIZE

KANGAROO POCKET
FOR LARGE GEAR STORAGE

H-LAYER
FOR COMPRESSION + GEAR SECURITY

PLASTIC BUCKLES
FOR LOW PROFILE CLOSURE + ADJUST

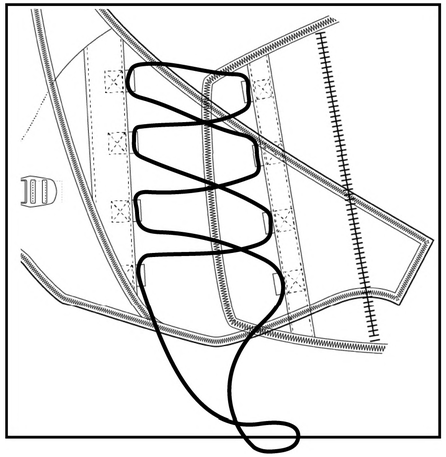
BLADDER POCKETS
FOR H2O



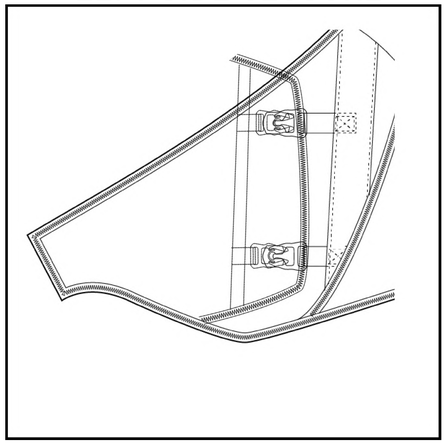
FRONT VIEW

BACK VIEW

RIGHT SIDE CLOSURE



LEFT SIDE CLOSURE



FEMALE RUNNING PACK INNOVATION

MATERIALS // MANUFACTURING

POWER MESH
84% nylon / 16% spandex, woven
4-way stretch + compression

SPACER MESH
polyester, woven
lightweight + cushioning

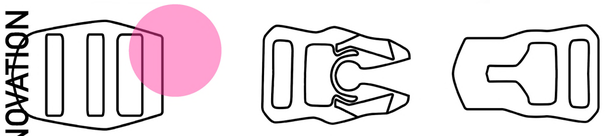
WEBBING
nylon, flat woven
strength + durability

BEMIS ADHESIVE
polyurethane, non-woven
structure

ELASTIC CORD
rubber + polyester, braided
elasticity + strength

TRIM
polyester + nylon, knit
stretch

PLASTIC COMPONENTS
polyoxymethylene
strength + ease of use



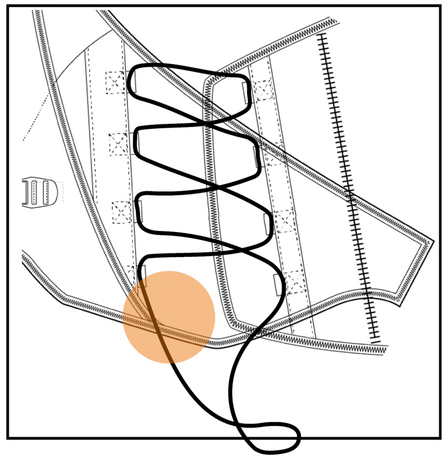
FEMALE RUNNING PACK INNOVATION

CONSTRUCTION METHODS

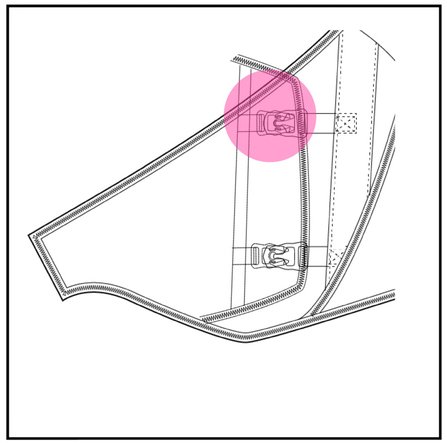
laser perforation	
sewing	8 SPI SNTS + DNTS 8 SPI ZigZag stitch
serge stitch	

FRONT VIEW BACK VIEW

RIGHT SIDE CLOSURE



LEFT SIDE CLOSURE



performance goals.

PERFORMANCE GOALS

75% of athletes report greater support

FIT AND COMFORT

75% of athletes report greater ease of access

GEAR ACCESSIBILITY

9-10 inches

PACK WEIGHT AND DISTRIBUTION

10% faster evaporation rate than average

COOLING AND EVAPORATION

performance testing.

PERFORMANCE TESTING

range of motion

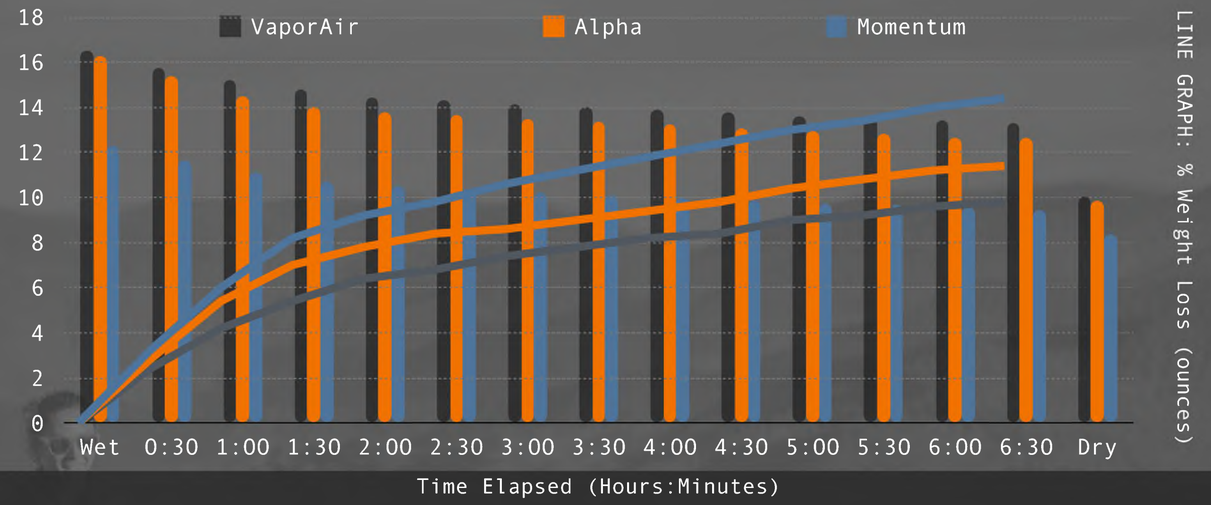
measure the average reach and range of motion of ultra-running athletes to determine most natural and comfortable pocket placement for accessibility.

pack weight

continuously weigh the packs to be able to justify the cost of adding more weight for the benefit of storage.

evaporative material testing

Measure the evaporation rate of packs and systems to develop a more efficient and effective method for heat and moisture management.



Evaporative Weight Loss of Benchmark Ultra-Running Hydration Packs

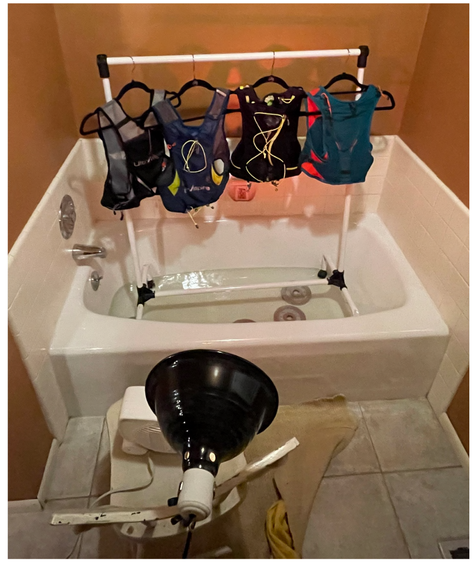
FEMALE RUNNING PACK INNOVATION

		ranking
10.05 ounces		2
9.84 ounces		3
8.36 ounces		1

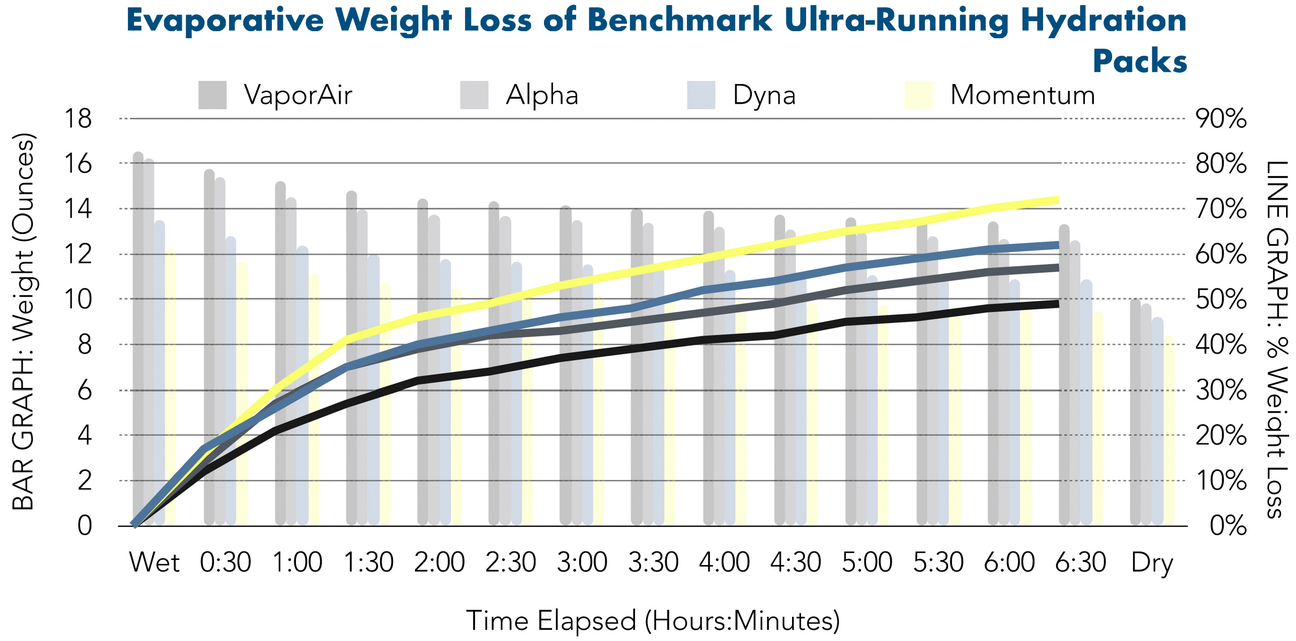
wear testing

qualitative insight into features of benchmark packs as athlete adjusts, interacts with, and ranks each pack based on features they like or dislike.

EVAPORATIVE WEIGHT LOSS TEST



FEMALE RUNNING PACK INNOVATION



Collect Data

PREPARE PACKS

- Prepare each pack the same, empty of all equipment.
- Submerge all packs in water for 10 minutes.
- Wring out packs evenly and leave to drip for 10 minutes.
- Prepare simulation room to be 75% humidity and 75 degrees Fahrenheit.

MATERIAL TESTING PACKS

- Hang the packs on a rack in front of the heat source.
- Every 7.5 minutes, rotate pack location and position.

Report Data

RECORD WEIGHT IN SPREADSHEETS

- Weigh packs every 30 minutes for 6.5 hours.

Translating Data into Design

QUANTITATIVE DATA IN DESIGN

- Use the data collected to design a lighter and more ventilated pack capable of thermoregulation of the athlete through heat dissipation via evaporation.

innovation testing.

INNOVATION TESTING

TECHNOLOGY

QUAD PLANE

COMPRESSION IN 4 DIRECTIONS STEMMING FROM THE POSTERIOR TO ANTERIOR AND VICE VERSA.

TESTING METHOD

WEAR-TESTING

COLLECT VERBAL QUALITATIVE AND VISUAL FIT FEEDBACK.

PERFORMANCE GOAL

HOW COULD WE APPLY COMPRESSION TO PROVIDE SUPPORT UNDER THE BUST AND TENSION ALONG THE SAGITTAL PLANE WHILE ALLOWING ADJUSTABILITY.

RESULTS

"I LIKE HOW IT HUGS AROUND THE SIDES AND UNDER THE BUST. IT MAKES IT FEEL MORE SECURE AND SUPPORTIVE."

1 FIT MODEL TESTED

INNOVATION TESTING

TECHNOLOGY

EQUILIBRIUM

CALCULATED TRADE-OFF BETWEEN GEAR CARRYING CAPACITY AND WEIGHT.

PERFORMANCE GOAL

HOW COULD WE DESIGN POCKETS TO STORE GEAR WHILE ALLOWING ON-THE-GO ACCESSIBILITY + EVEN WEIGHT DISTRIBUTION.

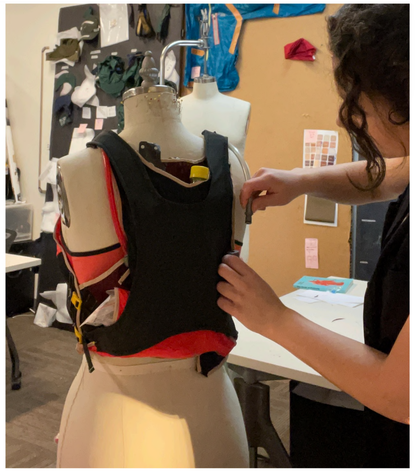
TESTING METHOD

COMPONENT PACK TESTING

A SUCCESSFUL DESIGN FITS THESE ITEMS COMFORTABLY WHILE ALLOWING EASE ACCESS. IS THERE ROOM FOR EACH ITEM? DOES THE ATHLETE REPORT BETTER STORAGE?

RESULTS



100% OF ITEMS FIT

INNOVATION TESTING

TECHNOLOGY

DRY-TEX

HEXAGONAL PATTERN FUSION BETWEEN HYDROPHILIC AND HYDROPHOBIC TEXTILES TO BRING THERMOREGULATION TO THE PRODUCT.

PERFORMANCE GOAL

HOW COULD WE COMBINE MATERIALS WITH UNIQUE PROPERTIES TO CREATE A NEW TEXTILE FOCUSED ON MOISTURE-WICKING AND HEAT MANAGEMENT.

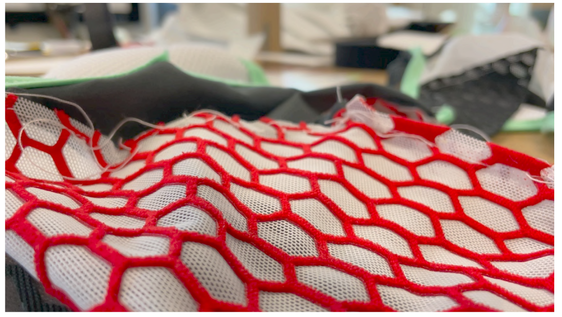
TESTING METHOD

EVAPORATIVE TESTING

SIMULATE ENVIRONMENT (75% HUMIDITY/ 75°F)
WEIGH MATERIAL EVERY 15 MINUTES
GREATER RATE OF EVAPORATION = MORE COOLING EFFICIENCY

RESULTS

NON-MOISTURE WICKING



MOISTURE WICKING TETRACOOL

prototypes.

FEMALE RUNNING PACK INNOVATION

PROTOTYPE PROGRESS



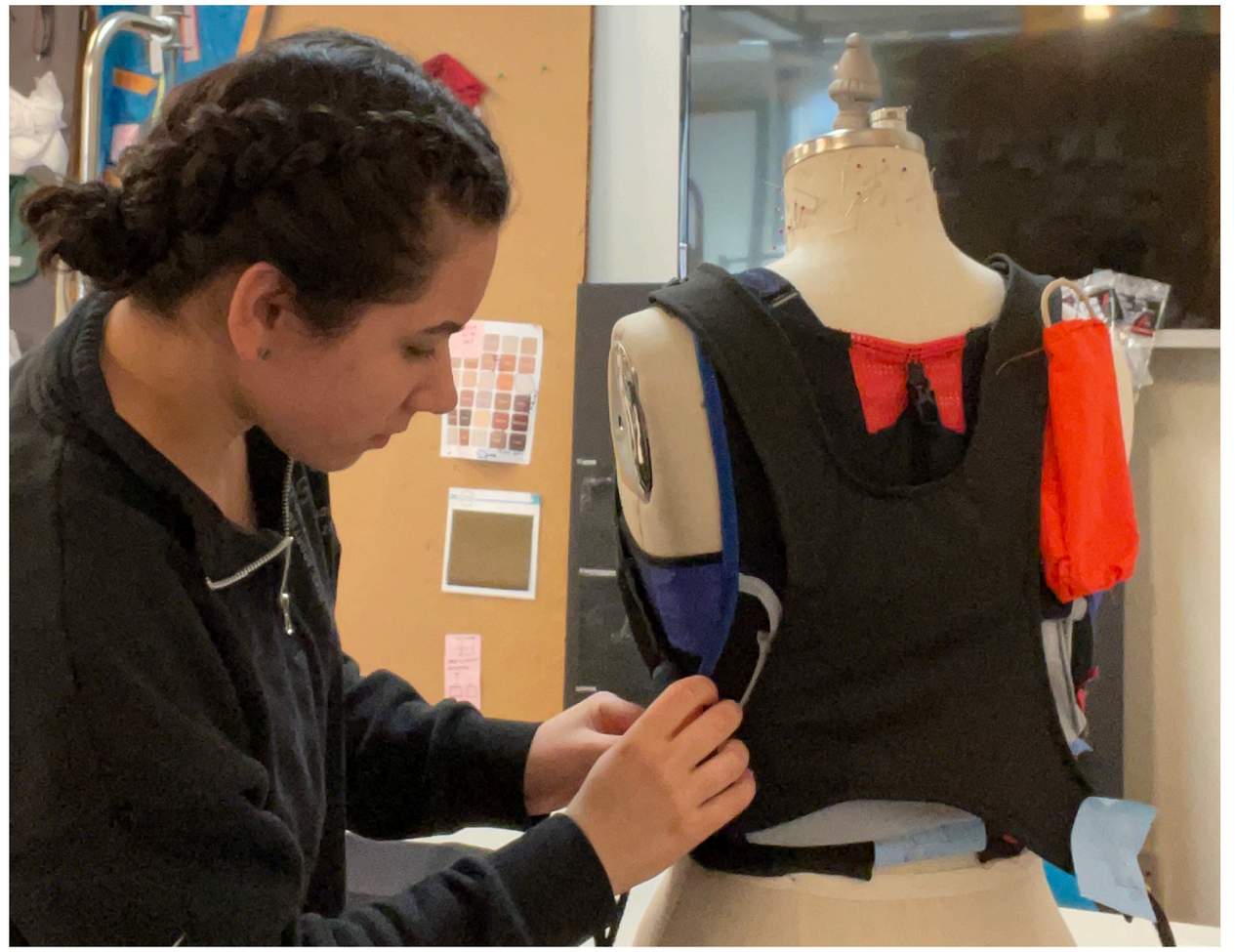


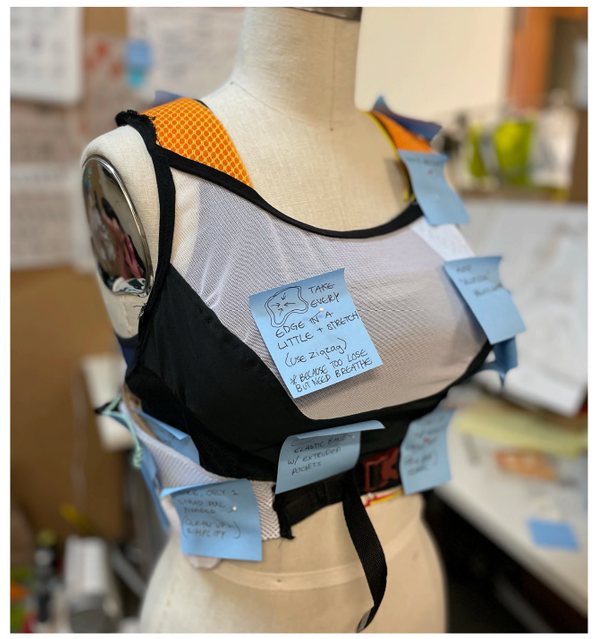
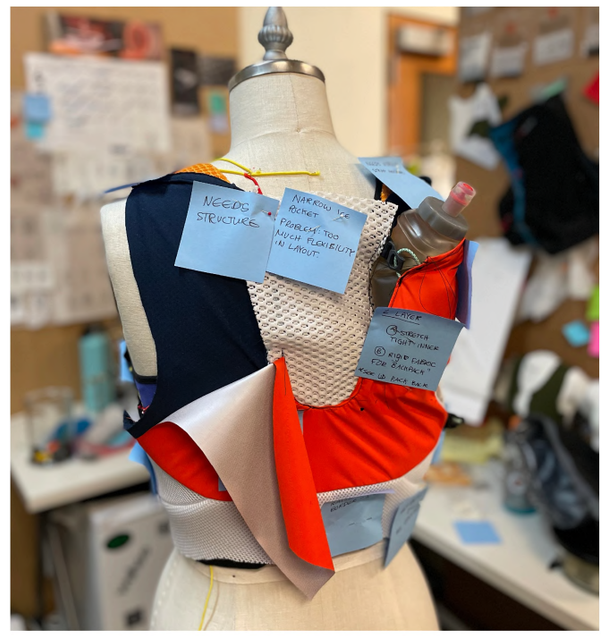

FEMALE RUNNING PACK INNOVATION

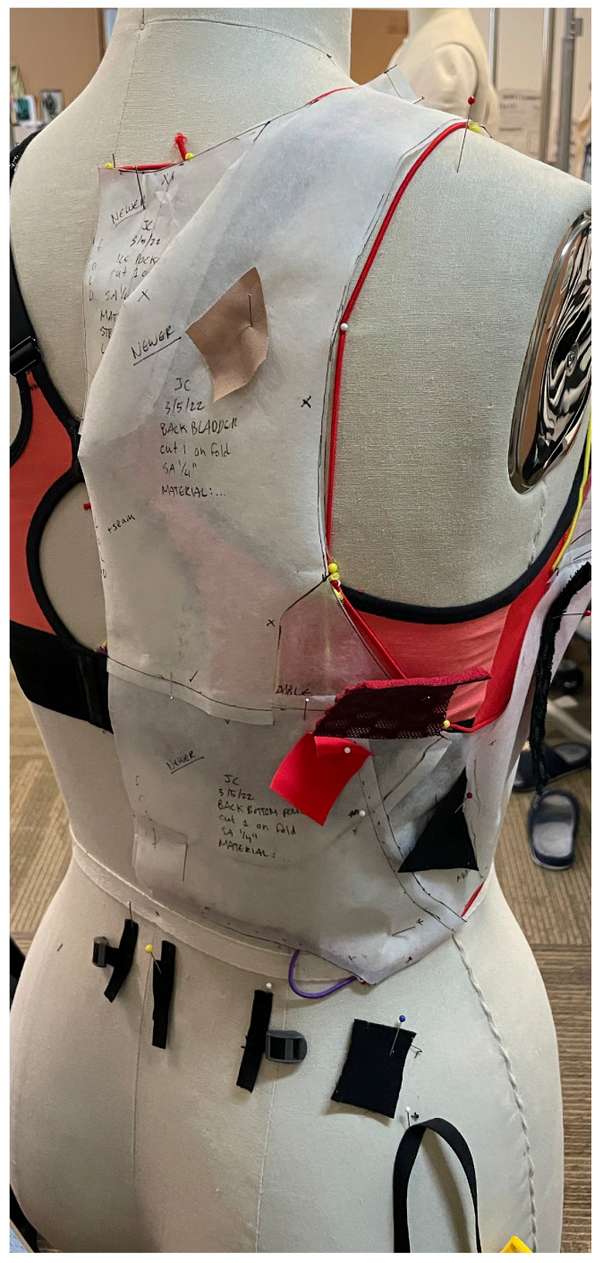
IDEATION PROCESS





FEMALE RUNNING PACK INNOVATION

FEMALE RUNNING PACK INNOVATION

QUAD PLANE

QUAD-PLANE
BUST COMFORT

TECHNOLOGY

COMPRESSION

STORAGE

HEAT RETENTION (VOLUME)

prototype testing.

"I don't like how most packs squish your boob and mess up the natural shape of them. My sports bras are pretty supportive and I like a pack that lets the bra do its job."

proof of concept.

QUAD PLANE

validation.

"INCREDIBLY INNOVATIVE DESIGN TO SUPPORT THE UPPER THORACIC SPINE AND MINIMIZE BUST EXCURSION."

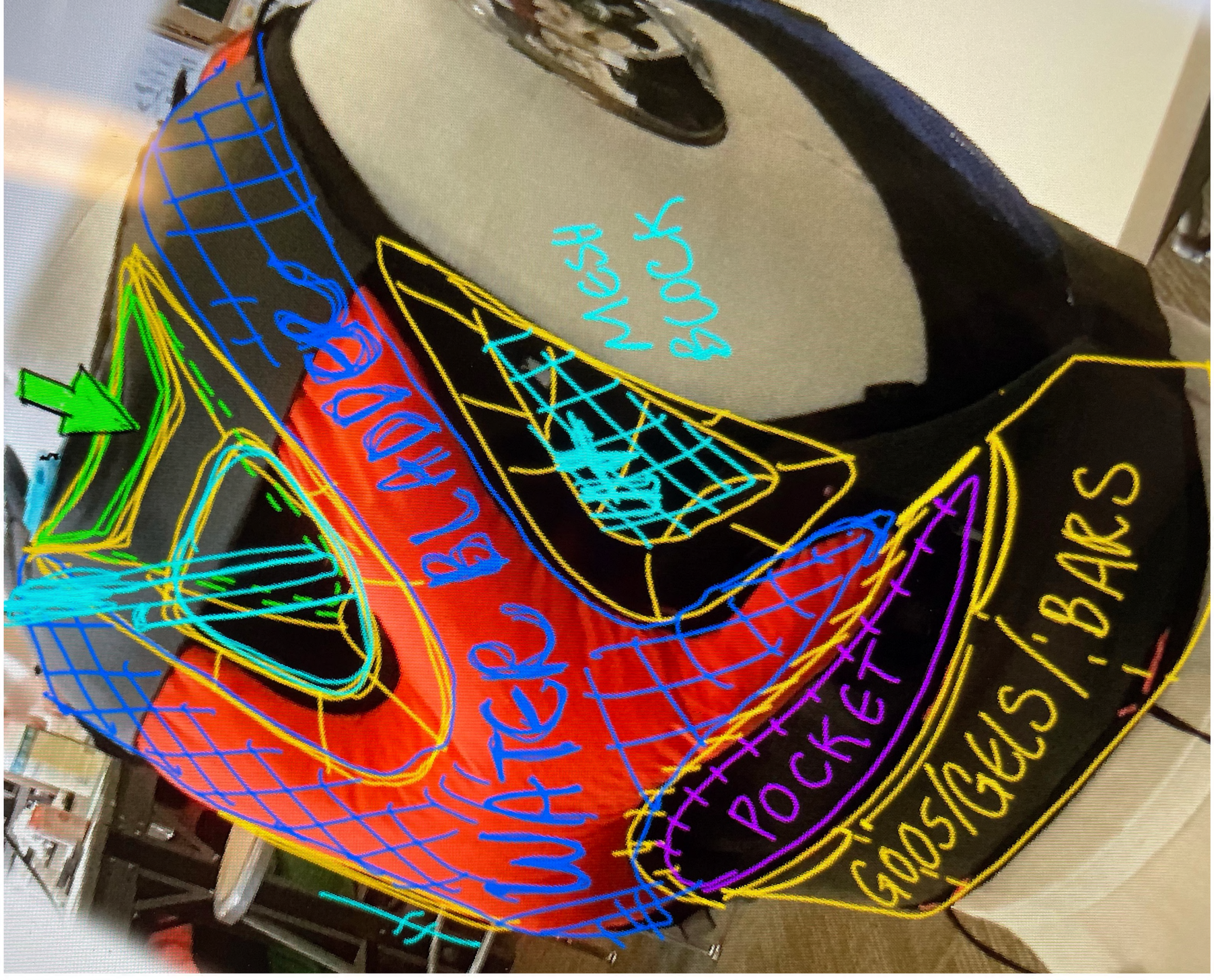
- KELLY CAMPBELL PT

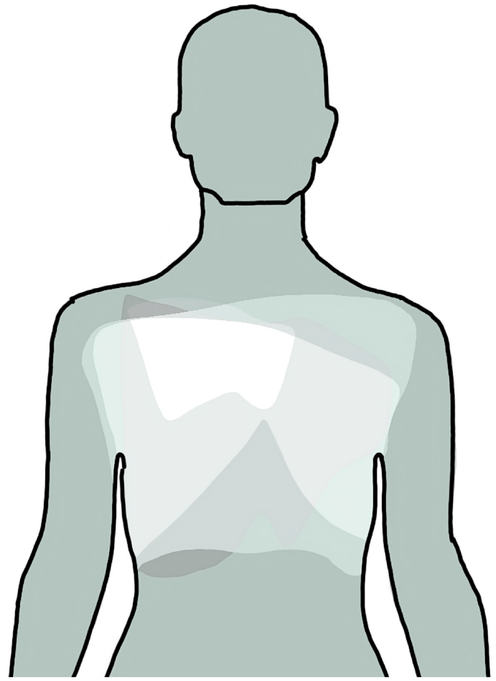
FEMALE RUNNING PACK INNOVATION

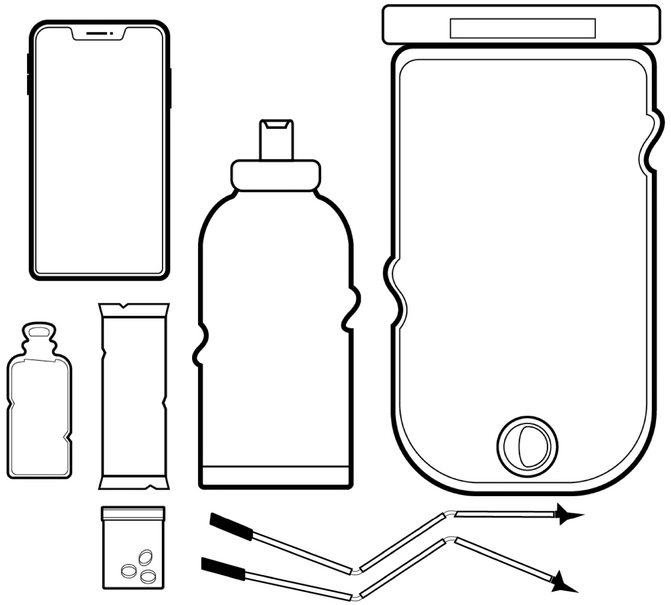
storage research.

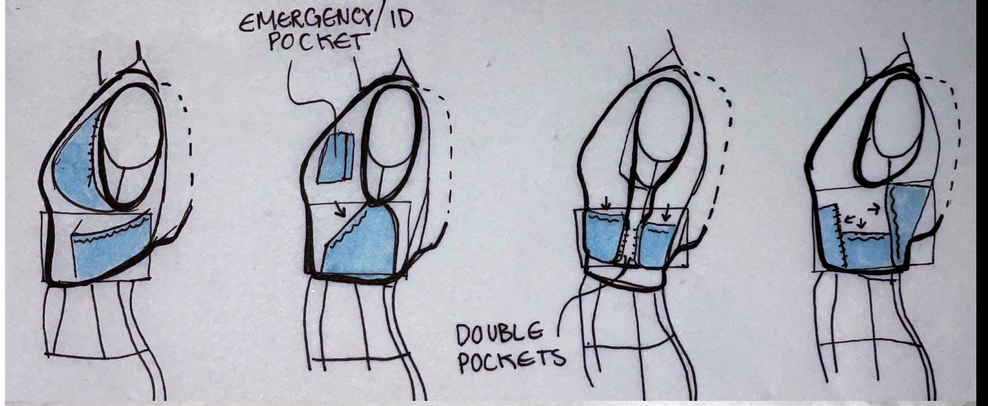
"...SOME RIGIDITY TO THE BLADDER [AND BOTTLES] SO THAT IT'S NOT SO HARD TO PUT BACK IN... ESPECIALLY WHEN HALF FULL."

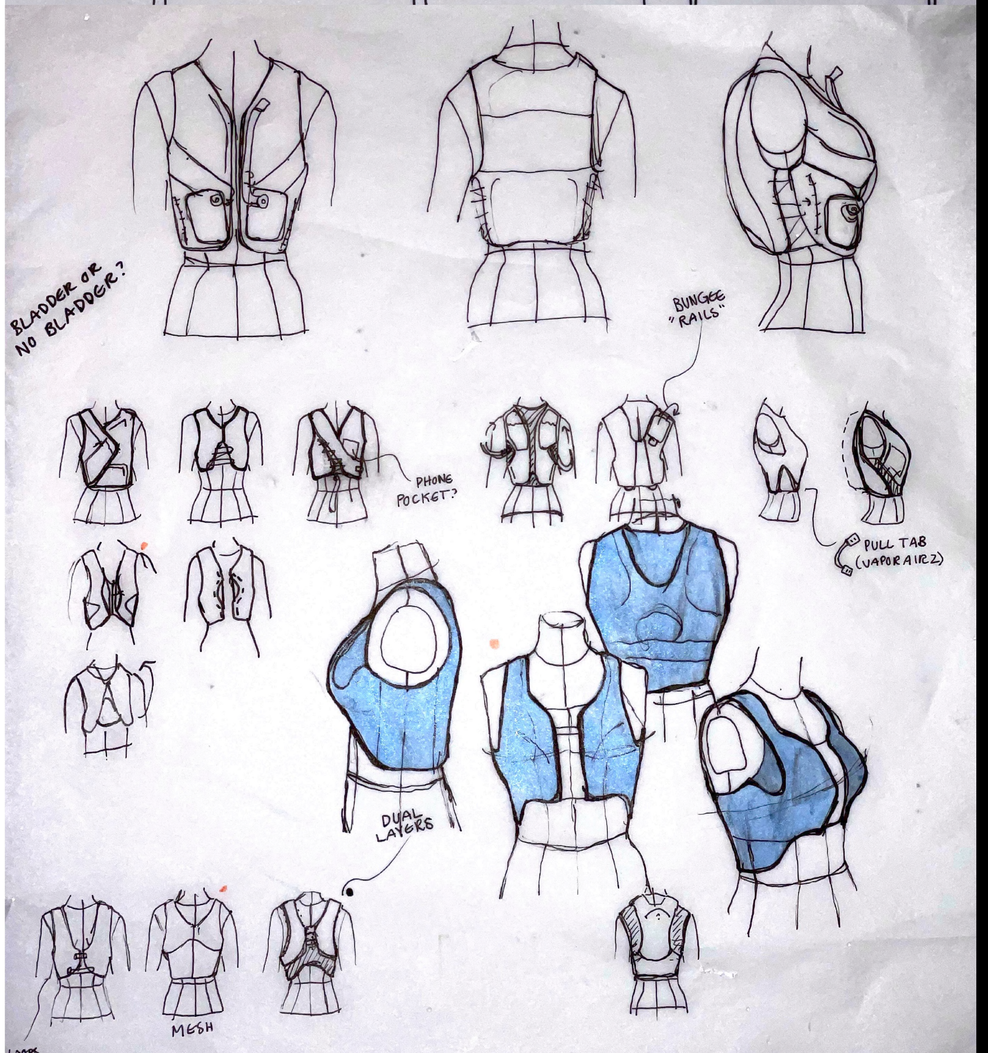
storage ideation.


MESH
BACK
POCKET
GOOSEGUARD









EQUILIBRIUM

storage proof of concept.

EQUILIBRIUM

FEMALE RUNNING PACK INNOVATION

thermoregulation research.

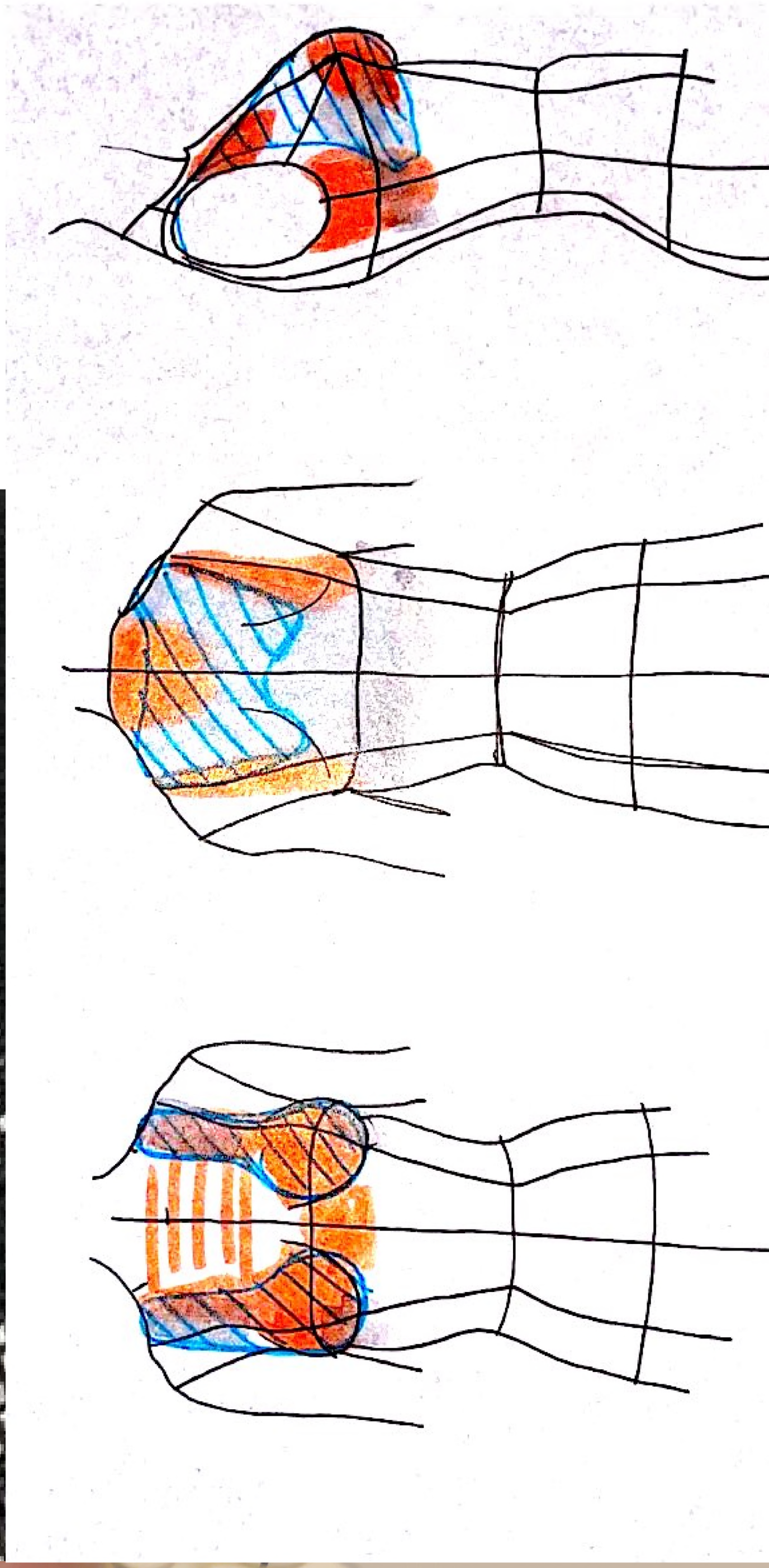
FEMALE SWEAT MAP

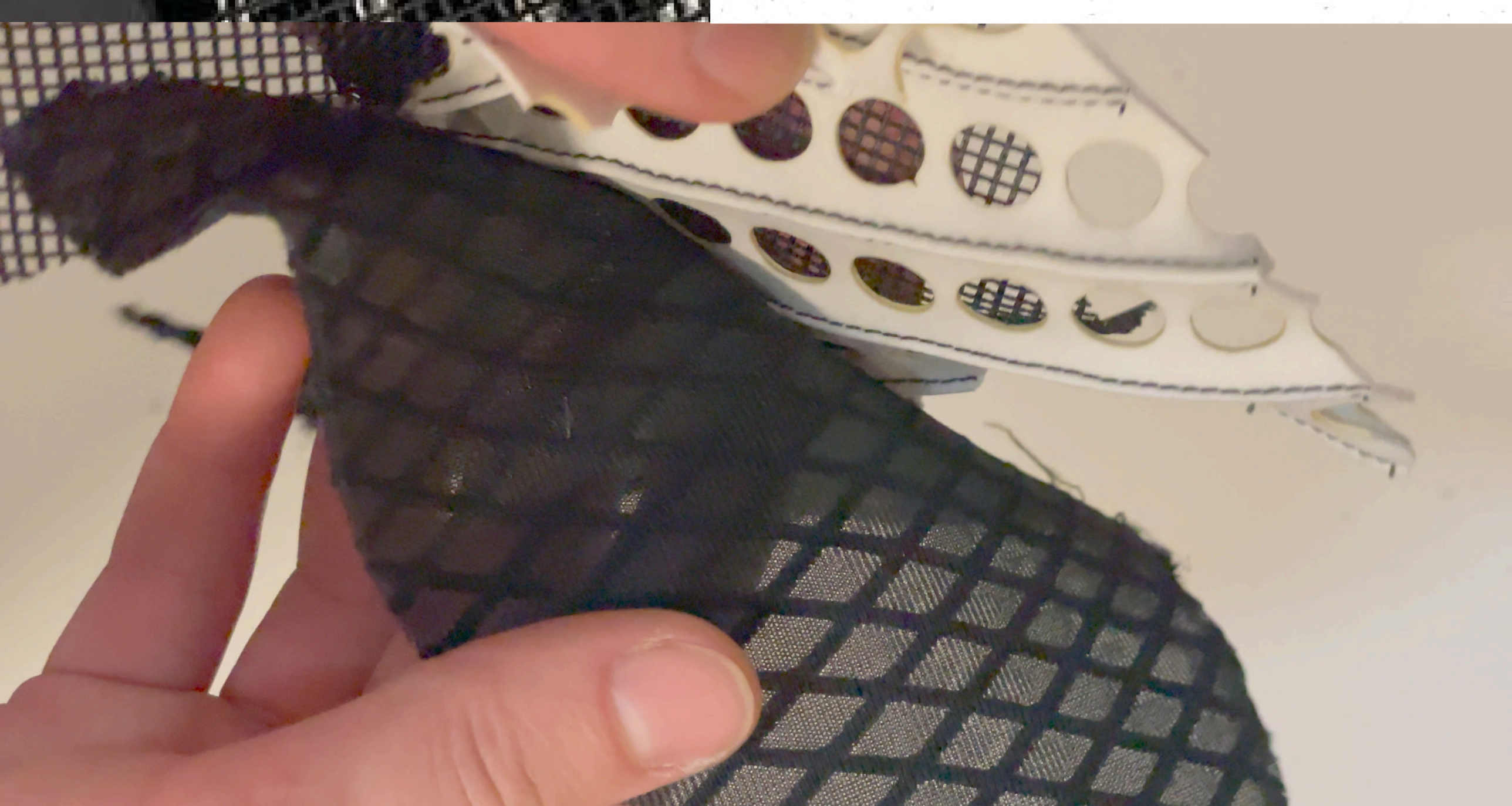
MALE SWEAT MAP

Smith, Caroline J and George Havenith. "Sweat mapping in humans and applications for clothing design." (2011).

thermoregulation ideation.

TECHNOLOGY - DRY-TEX





DRY-TEX

technologies.

QUAD-PLANE
BUST SUPPORT

EQUILIBRIUM
ACCESSIBLE STORAGE

DRY-TEX
MOISTURE MANAGEMENT

final iteration.

FEMALE RUNNING PACK INNOVATION

DUALXX RUNNING PACK

features + benefits.

SUPPORTIVE FIT

HEAT MANAGEMENT

ACCESSIBLE STORAGE

CLOSURE

SUPPORTIVE FIT

HEAT MANAGEMENT

ACCESSIBLE STORAGE

CLOSURE

SUPPORTIVE FIT

HEAT MANAGEMENT

ACCESSIBLE STORAGE

CLOSURE

SUPPORTIVE FIT

HEAT MANAGEMENT

ACCESSIBLE STORAGE

CLOSURE

SUPPORTIVE FIT

HEAT MANAGEMENT

ACCESSIBLE STORAGE

CLOSURE

SUPPORTIVE FIT

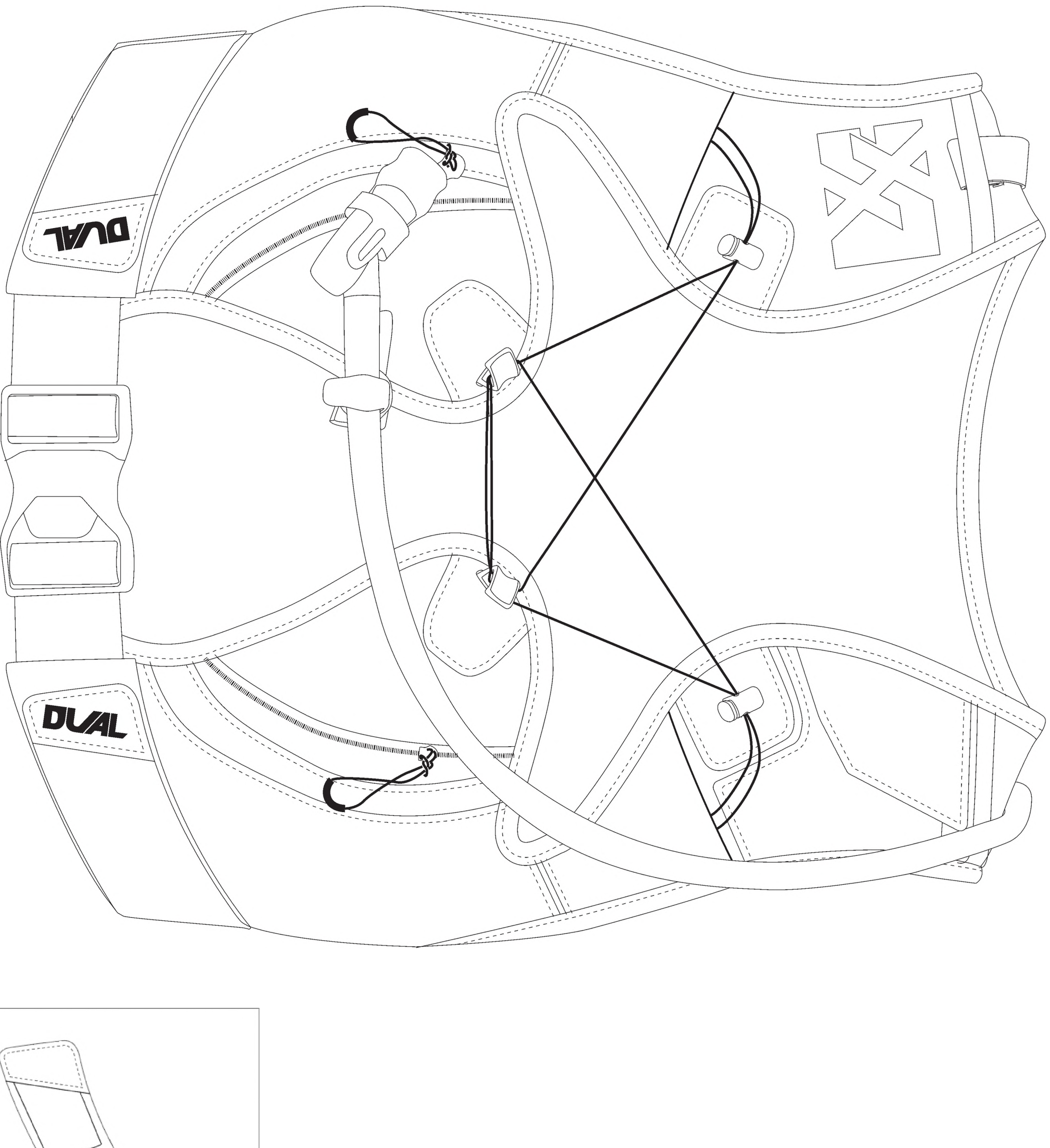
HEAT MANAGEMENT

ACCESSIBLE STORAGE

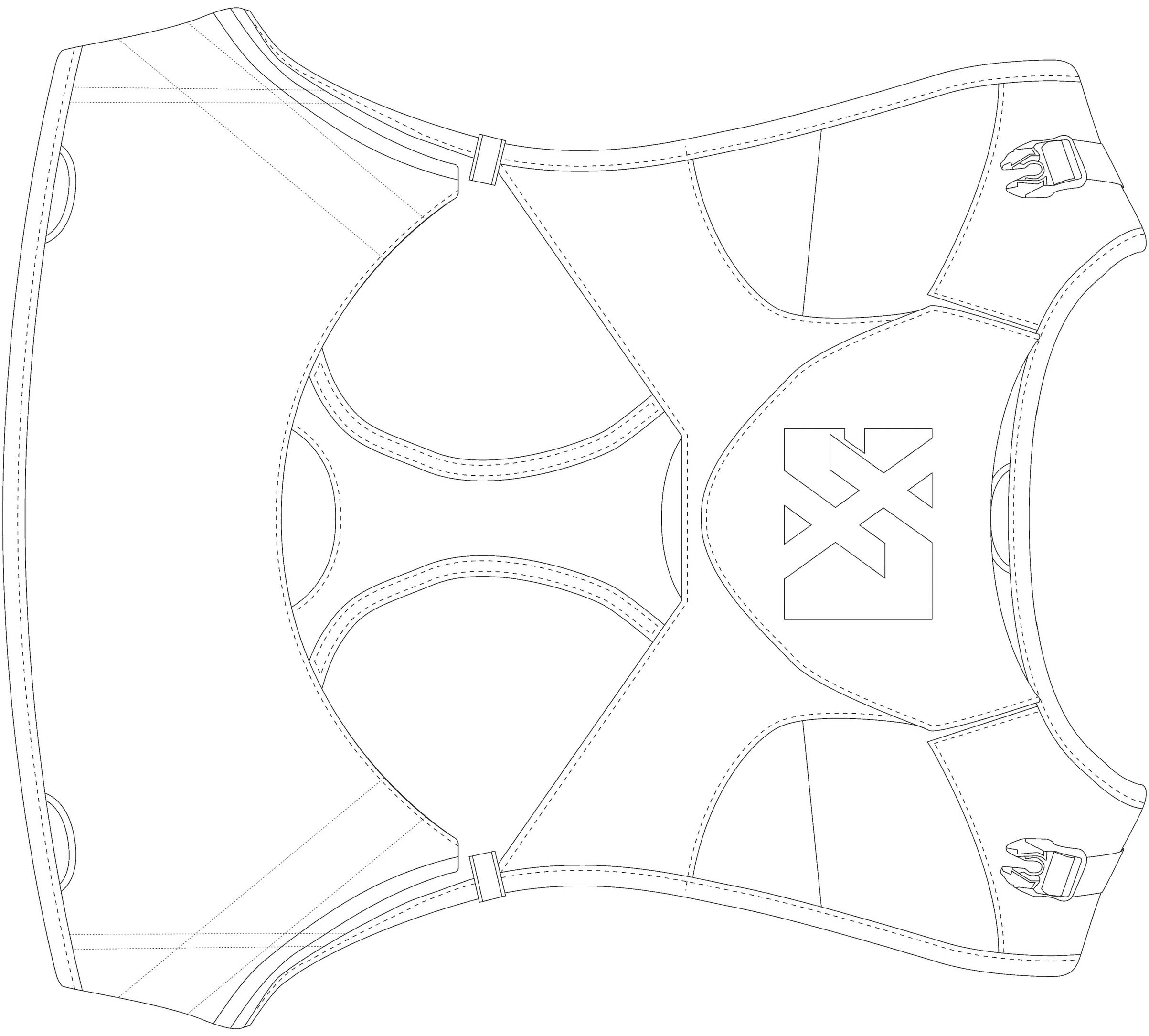
CLOSURE

tech packs.

FEMALE RUNNING PACK INNOVATION



FEMALE RUNNING PACK INNOVATION



BACK PANEL
CUSHIONING + BREATHABILITY

ICE/JACKET POCKET
NEXT-TO-SKIN COOLING

PLASTIC ZIPPER
WEATHER-PROOF GRIP + SECURITY

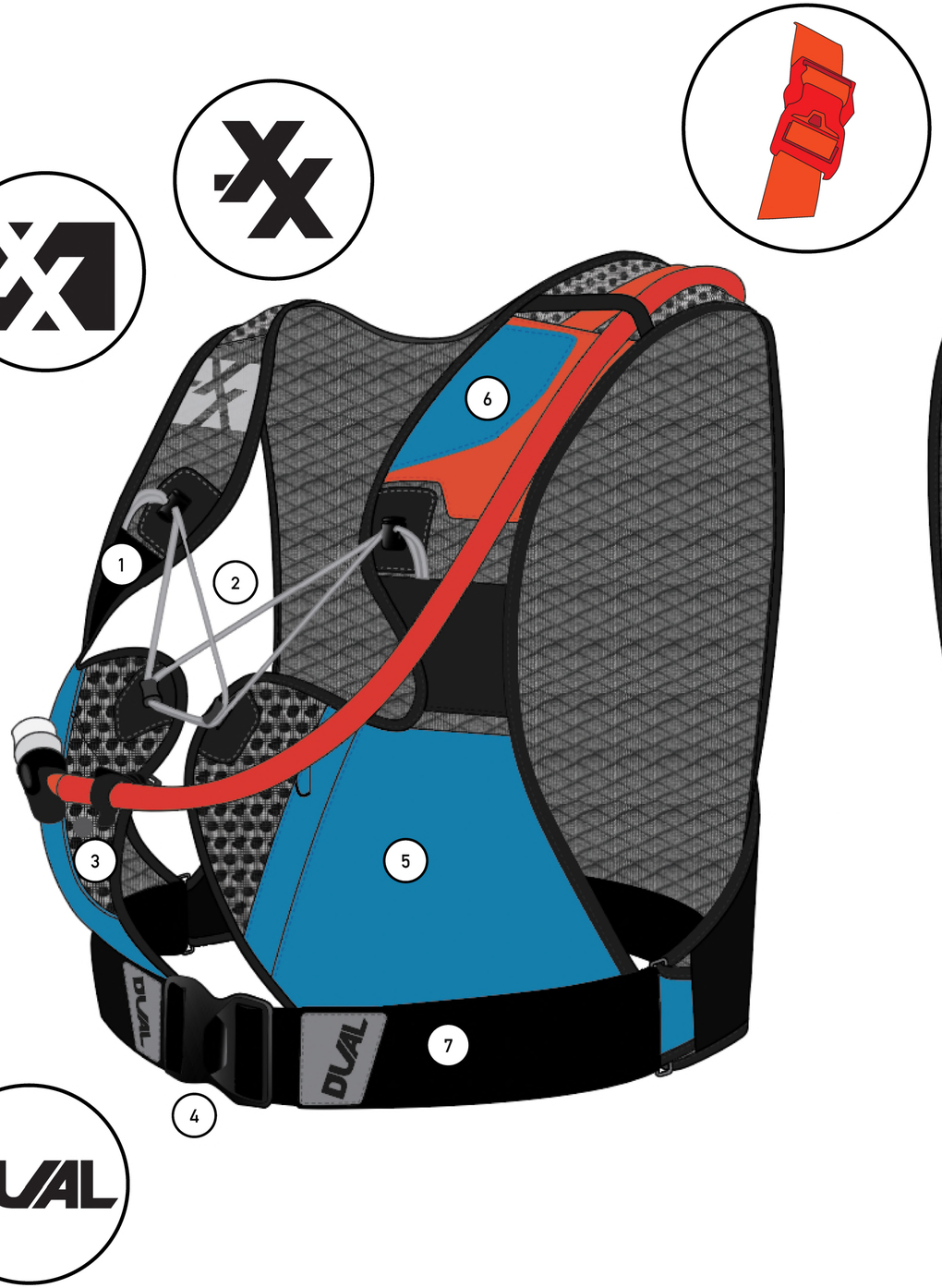
BLADDER HARNESS
H2O REMOVABILITY

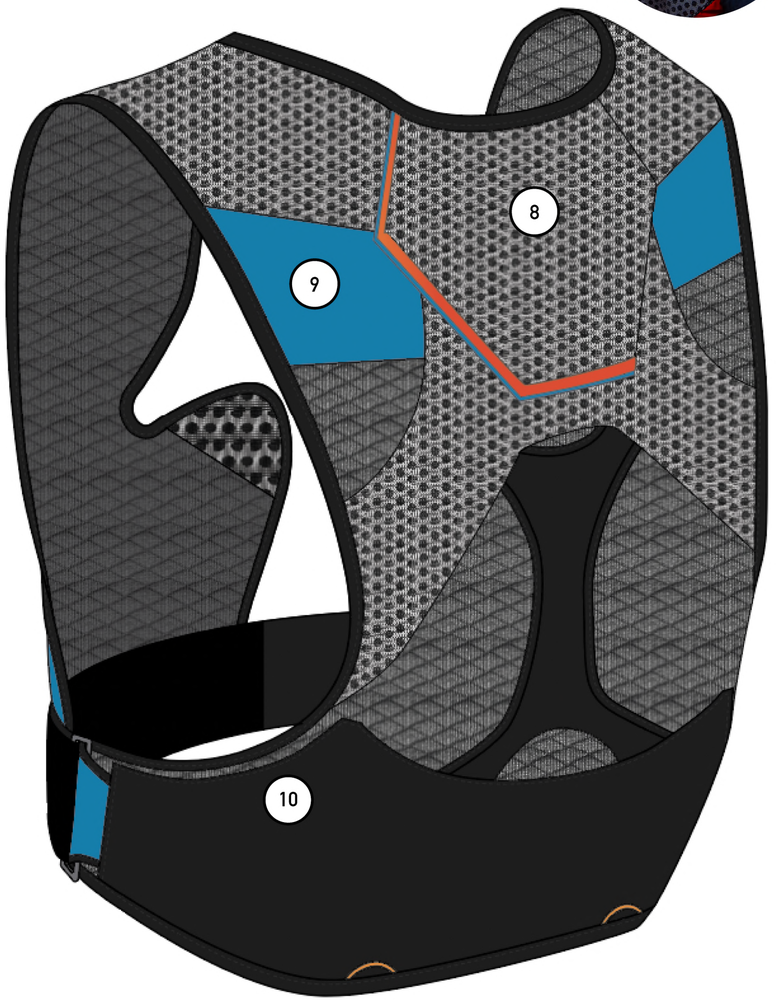
SIDE POCKET
FUEL STORAGE

FASTENING SYSTEM
ADJUSTABILITY + SECURITY

FEMALE RUNNING PACK INNOVATION

1. **TOGGLE STORAGE**
   COMFORT + SECURITY
2. **CORD CLOSURE**
   COMPRESSION + SUPPORT
3. **WATER TUBE CLIP**
   COMFORT + SECURITY
4. **SINGLE-HAND BUCKLE**
   LOW PROFILE + LOW DEXTERITY
5. **SIDE POCKET**
   FUEL STORAGE
6. **DRY POCKET**
   WEATHER-PROOF + SECURE
7. **VELCRO SYSTEM**
   ADJUSTABILITY + COMPRESSION
8. **THIN-LAYER POCKET**
   ICE + CLOTHING STORAGE
9. **CLOSED-CELL FOAM**
   CUSHIONING + COMFORT
10. **KANGAROO POCKET**
    STORAGE + SECURITY



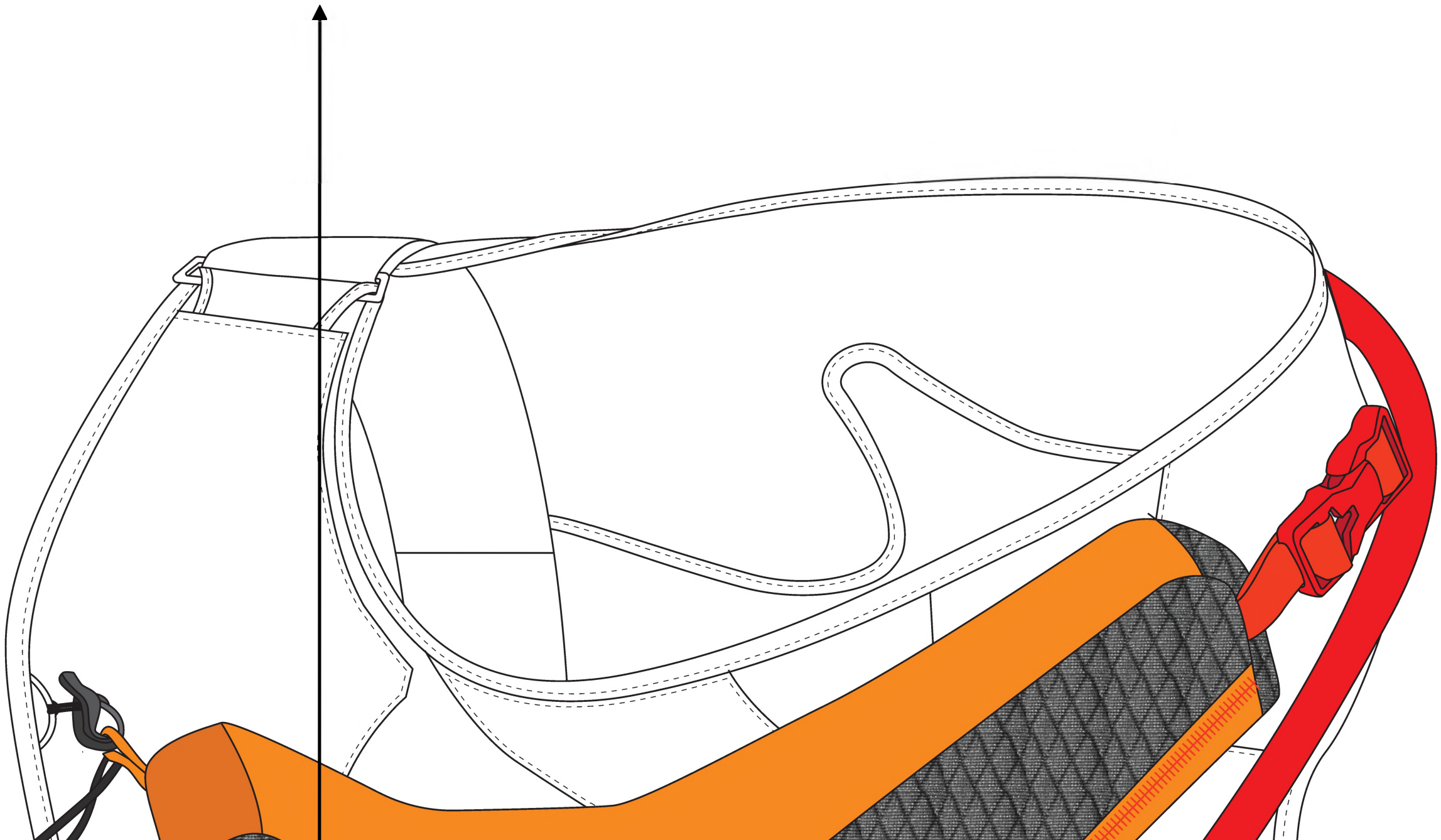


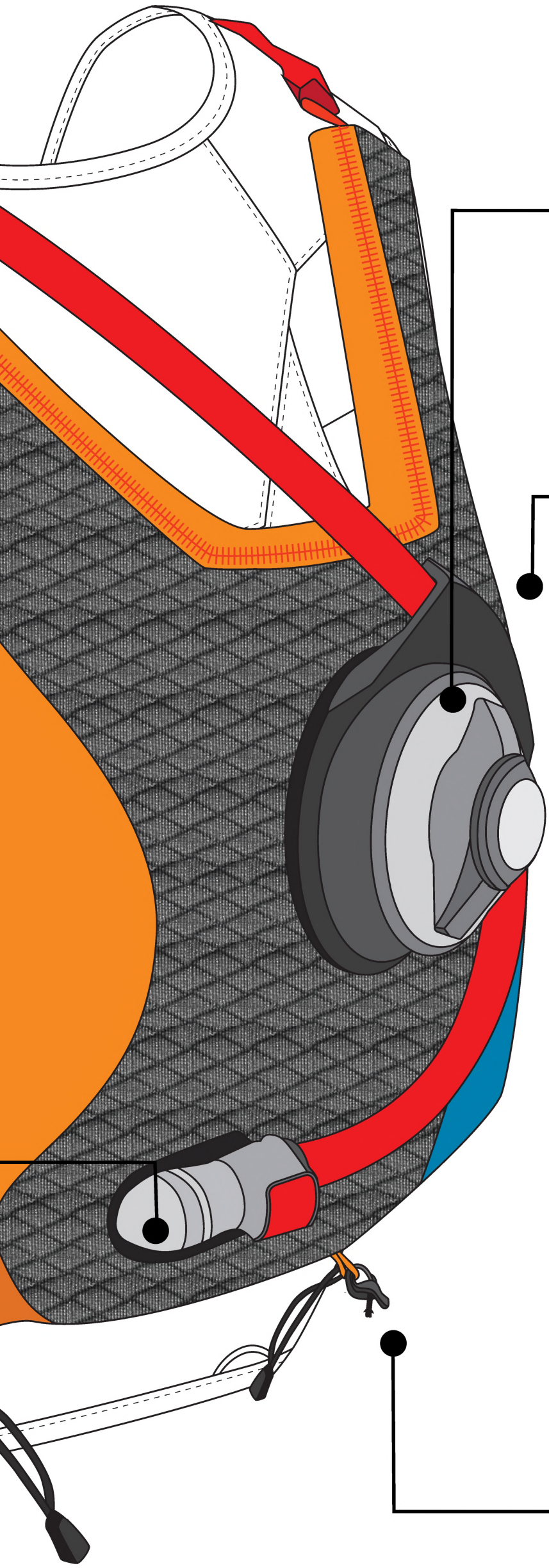
CIRCULAR SYSTEM

FEMALE RUNNING PACK INNOVATION

DETACHABLE NOZZLE

EASE OF USE





QUICK ACCESS TWIST CAP

EASE OF USE + EFFICIENCY

TUBE SECUREMENT

TUBE SIDE VERSATILITY

PLASTIC LOOP FASTENERS

SECURE BLADDER + ADAPTABILITY

product details.

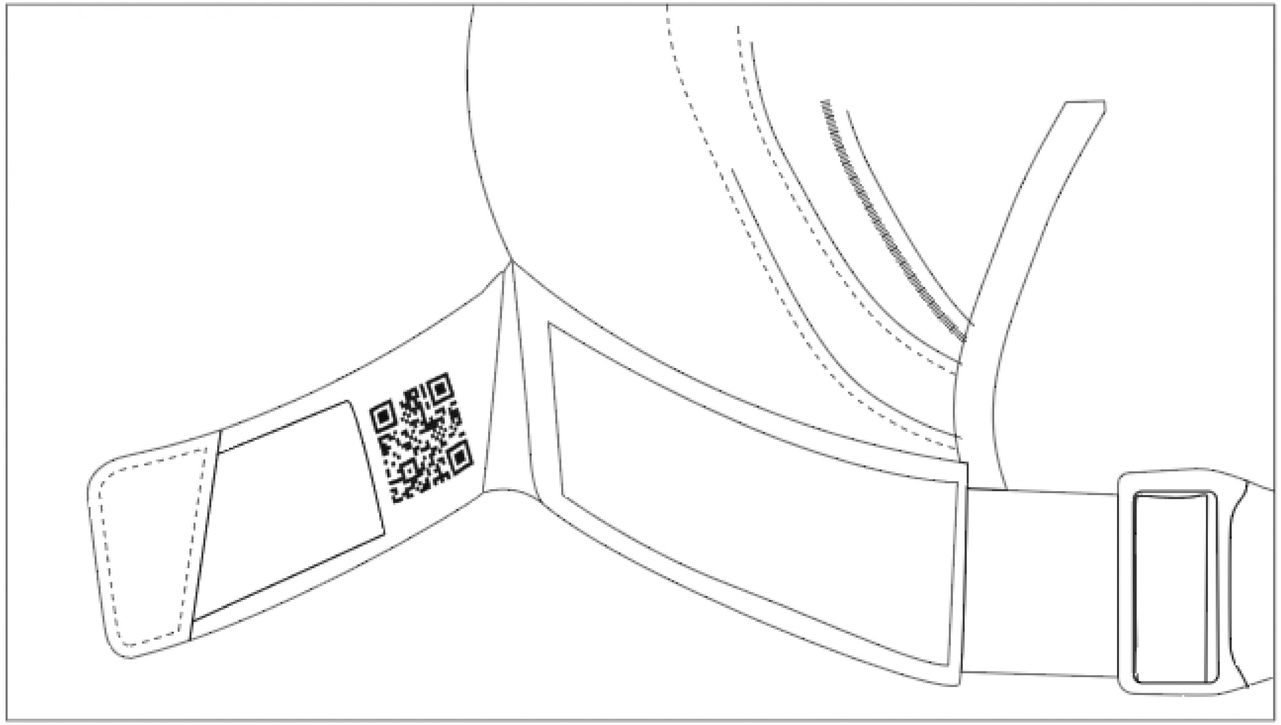
BLADDER

FEMALE RUNNING PACK INNOVATION

FEMALE RUNNING PACK INNOVATION

BLADDER

packaging.



QR SECURITY ID

NAME
AGE
EMERGENCY CONTACT
MEDICAL INFORMATION
BLOOD TYPE
CONDITIONS
INSTRUCTIONS

PACKAGING (INSTRUCTIONS GUIDE)

LIST + LINK OF FUNCTIONS AND FEATURES
WASHING INSTRUCTIONS